Clemson University
3 1604 019 888 348

Digitized by the Internet Archive
in 2013

http://archive.org/details/watersupplyirrig318unit

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 318

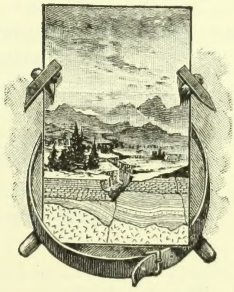
WATER RESOURCES OF HAWAII

1909–1911

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

W. F. MARTIN AND C. H. PIERCE



WASHINGTON
GOVERNMENT PRINTING OFFICE
1913

CONTENTS.

	Page.
Authority for investigations	11
Cooperation and acknowledgments	12
Purpose and scope of invstigations	15
Field methods for measuring stream flow	16
Base data	16
Weir measurements	17
Velocity-area method	19
Definition of terms	23
Convenient equivalents	25
Office methods of computing and studying discharge and run-off	26
Explanation of tables	29
Accuracy and reliability of field data and comparative results	31
Gaging stations maintained in Hawaii	32
Island of Kauai	36
General features	36
Waimea River basin	39
General features	39
Waimea River near Waimea	40
Kawaikoi Stream near Waimea	43
Waikoali Stream near Waimea	48
Mohihi Stream near Waimea	52
Waialae Stream near Waimea	56
Kekaha ditch at intake near Waimea	59
Kekaha ditch at flume No. 3, near Waimea	62
Kekaha ditch at siphon, near Waimea	63
Kekaha ditch at weir, below tunnel No. 12, near Waimea	64
Waimea ditch near Waimea	67
Kamenehune ditch near Waimea	68
Makaweli River basin	70
General features	70
Makaweli River near Waimea	70
Olokele ditch at tunnel No. 12 near Makaweli	71
Poowaiomahaihai ditch near Waimea	75
Hanapepe River basin	76
General features	76
Hanapepe River at Hanapepe Falls, near Eleele	77
Hanapepe River at Koula, near Eleele	78
Hanapepe ditch at Hanapepe Falls, near Eleele	81
Hanapepe ditch at Koula near Eleele	82
Hanapepe ditch at weir near Makaweli	85
Hiloa Stream at Hanapepe Falls, near Eleele	86
Hiloa ditch at Hanapepe Falls, near Eleele	87
Hanamaulu River	88
Hanamaulu River at Kapaia, near Lihue	88

Island of Kauai—Continued. Page.
Wailua River basin 90
General features 90
South Fork of Wailua River at siphon, near Lihue 91
South Fork of Wailua River above Waiehu Falls 94
Lihue ditch near Lihue 95
Hanamaulu ditch near Lihue 98
North Fork Wailua River near Lihue 101
Kanaha ditch near Lihue 105
Konohiki and Kaehulua Stream basins 106
Weir stations near Kapaa 106
Kapaa River basin 111
General features 111
Kapaa River at Kapahi, near Kapaa 111
Akulikuli Springs near Kapaa 114
Kapahi ditch at Kapahi, near Kapaa 115
Tunnel ditch at Kapahi, near Kapaa 118
Kapaa ditch at Kapahi, near Kapaa 121
Pipe ditch at Kapahi, near Kapaa 123
Kaneha ditch at Kaneha, near Kealia 125
Anahola River basin 128
General features 128
Anahola River above dam at Kiokala, near Kealia 129
Anahola River at Kiokala dam, near Kealia 130
Anahola ditch at Kiokala, near Kealia 132
Anahola ditch at Makai weir, near Kealia 135
Hanalei River basin 137
General features 137
Hanalei River near Hanalei 138
China ditch near Hanalei 138
Wainiha River basin 139
General features 139
Wainiha River at power house, near Wainiha 139
Wainiha canal at intake, near Wainiha 139
Wainiha canal at tunnel No. 18, near Wainiha 141
Wainiha canal at tailrace, near Wainiha 142
Miscellaneous measurements on Kauai Island 143
Pumped water on Kauai 144
Island of Oahu 145
General features 145
Palolo Stream basin 148
General features 148
Waiomao Stream at 950-foot elevation, near Honolulu 149
Waiomao Stream above Pukele Stream, near Honolulu 149
Miscellaneous measurements 151
Manoa Stream basin 152
General features 152
Manoa Stream at upper end of valley, near Honolulu 152
Manoa Stream at College of Hawaii, near Honolulu 155
Manoa Stream at Waialae Road, near Honolulu 157
Miscellaneous measurements 159
Pauoa Stream basin 160
General features 160
Pauoa Stream in Pauoa Valley, near Honolulu 160
Miscellaneous measurements 162

Island of Oahu—Continued. Page.
Nuuanu Stream basin ... 163
General features ... 163
Nuuanu Stream at Kuakini Street, Honolulu ... 163
Lulumaho ditch in Nuuanu Valley, near Honolulu ... 164
Luakaha weir in Nuuanu Valley, near Honolulu ... 166
Miscellaneous measurements ... 168
Kalihi Stream basin ... 168
Kaukonahua Stream basin ... 169
General features ... 169
South Fork of Kaukonahua Stream near Wahiawa ... 169
North Fork of Kaukonahua Stream near Wahiawa ... 170
Wahiawa reservoir ditch near Wahiawa ... 171
Waianae Stream basin ... 173
Kaipapau Stream basin ... 173
Kaipapau Stream near Hauula ... 173
Kaluanui Stream basin ... 174
Kaluanui Stream near Hauula ... 174
Miscellaneous measurements ... 175
Punaluu Stream basin ... 176
Punaluu Stream near Hauula ... 176
Miscellaneous measurements ... 176
Kahana Stream basin ... 177
Waikane Stream basin ... 177
Waiahole Stream basin ... 178
General features ... 178
Waiahole Stream at Manianiaula near Waikane ... 178
Waiahole Stream at Waiahole near Waikane ... 180
Waihi Stream near Waikane ... 181
Halona Stream near Waikane ... 182
Waianu Stream near Waikane ... 182
Miscellaneous measurements ... 183
Kaneohe Stream basin ... 184
Kailua Stream basin ... 185
Waimanalo Stream basin ... 185
General miscellaneous measurements ... 186
Springs and artesian wells ... 187
Use and character ... 187
Miscellaneous measurements ... 188
Well sections ... 191
Summaries of pumped water ... 193
Water pumped by Honolulu Plantation Co ... 193
Water pumped by Oahu Sugar Co ... 193
Water pumped by Ewa Plantation Co ... 194
Water pumped by Waialua Agricultural Co ... 195
Island of Molokai ... 196
General features ... 196
Water resources ... 197
Island of Maui ... 197
General features ... 197
West Maui ... 199
Waihee Stream basin ... 199
General features ... 199
Waihee Stream near Waihee ... 199
Waihee canal near Waihee ... 202

Island of Maui—Continued.
West Maui—Continued.
Waihee Stream basin—Continued. Page.
Waihee canal at weir near Wailuku 205
Spreckels ditch near Waihee 206
Spreckels ditch at Waiale weir near Wailuku 208
Waiehu Stream basin 210
General features 210
North Waiehu Stream near Wailuku 211
North Waiehu ditch near Wailuku 212
South Waiehu Stream near Wailuku 215
Iao Stream basin 218
General features 218
Iao Stream near Wailuku 218
Maniania ditch near Wailuku 222
Waikapu Stream basin 225
General features 225
Waikapu Stream near Waikapu 225
South Side Waikapu ditch near Waikapu 228
Palolo (Everett) ditch near Waikapu 231
Ukumehame Stream basin 234
General features 234
Ukumehame Stream near Olowalu 234
Olowalu Stream basin 235
Olowalu ditch No. 1 near Olowalu 235
Launiupoko Stream basin 236
Launiupoko Stream near Lahaina 236
Kauaula Stream basin 237
General features 237
Kauaula Stream near Lahaina 238
Kauaula weirs Nos. 1, 2, and 3 near Lahaina 238
Lahainaluna Stream basin 239
General features 239
Lahainaluna Stream near Lahaina 239
Lahainaluna weirs Nos. 1 and 2 near Lahaina 241
Kahoma Stream basin 241
General features 241
Kahoma Stream near Lahaina 242
Kahoma Stream at weirs Nos. 1 and 2, near Lahaina 242
Kahoma ditch at weir near Lahaina 243
Honokawai Stream basin 244
General features 244
Honokawai Stream near Lahaina 244
Honokawai Stream at weir No. 1 near Lahaina 245
Honolua Stream basin 246
General features 246
Honolua Stream near Honokahau 246
Honolua ditch near Honokahau 247
Honokahau Stream basin 247
General features 247
Honokahau Stream near Honokahau 247
Honokahau ditch at intake, near Honokahau 248
Honokahau ditch above Honolua Stream, near Honokahau 252
Honokahau ditch at Honokawai weir, near Lahaina 254

Island of Maui—Continued.
West Maui—Continued. Page.
Miscellaneous measurements ... 256
Pumped water on West Maui ... 258
East Maui ... 259
The ditch country ... 259
Koolau ditch region ... 260
General features ... 260
Koolau ditch near Keanae ... 260
Koolau ditch at Alo division wier, near Huelo ... 262
Spreckles ditch region ... 268
General features ... 268
Haipuaena Stream near Huelo ... 268
Puohakamoa Stream near Huelo ... 271
Alo Stream near Huelo ... 274
Waikamoi Stream near Huelo ... 276
Oopuola Stream near Huelo ... 278
Spreckels ditch at station No. 1, near Huelo ... 281
Spreckels ditch at station No. 2, near Huelo ... 284
Spreckels ditch at station No. 3, near Huelo ... 285
Spreckels ditch at station No. 4, near Huelo ... 287
Spreckels ditch at station No. 5, near Huelo ... 290
Spreckels ditch at station No. 6, near Huelo ... 291
Spreckels ditch at station No. 7, near Huelo ... 292
Spreckels ditch at station No. 8, near Huelo ... 293
Center ditch region ... 294
Center ditch near Huelo ... 294
Hamakau ditch region ... 298
General features ... 298
Nailiilihaele Stream near Huelo ... 298
Kailua Stream near Huelo ... 301
Oanui Stream near Huelo ... 302
Hoolawaliilii Stream near Huelo ... 306
Hoolawanui Stream near Huelo ... 308
Honopou Stream near Huelo ... 310
Halehaku Stream at dam near Huelo ... 312
Halehaku Stream weir near Huelo ... 314
Opana Stream near Huelo ... 316
Opana ditch near Huelo ... 317
New Hamakua ditch at Nailiilihaele weir, near Huelo ... 318
New Hamakua ditch at Halehaku weir, near Huelo ... 320
Old Hamakua ditch at Opana weir, near Huelo ... 322
Kaluanui ditch at Puuomalei, near Hamakuapoko ... 324
Lowrie ditch at Opana weir, near Huelo ... 326
Haiku ditch at Peahi weir, near Huelo ... 328
Miscellaneous measurements ... 330
Pumped water on East Maui ... 331
Island of Hawaii ... 332
General features ... 332
Hilo group of streams ... 336
General features ... 336
Wailuku River basin ... 337
General features ... 337
Wailuku River near Hilo ... 337

Island of Hawaii—Continued.
Hilo group of streams—Continued. Page.
Honolii River basin 340
General features 340
Honolii River at Kaiwiki, near Hilo 341
Honolii ditch at Kaiwiki, near Hilo 344
Kawainui River basin 344
General features 344
Kawainui River at Kawainui, near Pepeekeo 345
Stations at 2,500-foot elevation, near Hilo 346
General features 346
Combined flow 347
Miscellaneous measurements 389
Measurements at 1,800 to 2,000 feet elevation in forest back of Hilo 389
Measurements between Hilo and Laupahoehoe 390
Other streams and flumes 391
Hamakua group of streams 392
General features 392
Waipio River basin 392
General features 392
Kawainui of Waipio River near Waipio 393
Waipio River below Koiawe near Waipio 394
Waipio River below Waima near Waipio 394
New Hamakua ditch at Waima near Waipio 395
New Hamakua ditch at weir near Kukuihaele 395
Discharge measurements of Waipio River and tributaries in 1901–2. 397
Miscellaneous measurements 402
Kohala group of streams 403
General features 403
Honokane Stream basin 403
Discharge measurements of East and West branches in 1901 403
Kohala ditch near Kohala 405
Miscellaneous measurements 407
Springs and underground waters 408
Rainfall records 408
General features 408
Island of Kauai 409
Island of Oahu 429
Islands of Maui and Kahoolawe 443
Island of Hawaii 462
Evaporation from water surface 486
Appendix 496
Pronunciation of Hawaiian words 496
Glossary of Hawaiian words in common use 496
Meaning of geographic names 498
Glossary of some geographic names and words frequently occurring in geographic names 498
Principal watercourses, by islands 506
Gazetteer 509
Index 537

ILLUSTRATIONS.

Page.

PLATE I. Map showing relative position of the islands of the Territory of Hawaii 11

II. *A*, Rice cultivation: Preparing field for planting; *B*, Sugar cane and irrigation ditch, Oahu 14

III. *A*, Banana plantation near Honolulu; *B*, Hawaiian cultivating taro. 15

IV. Types of gaging stations: *A*, Weir gaging station, Wahiawa Reservoir ditch, Oahu; *B*, Velocity-area gaging station, Waiahole Stream, Oahu 16

V. Small Price current meters 18

VI. Typical gaging stations: *A*, Bridge station on North Fork of Wailua River, Kauai; *B*, Cable station on Hanapepe River, Kauai 19

VII. Typical waterfalls: *A*, Kahoalele Falls, Kauai; *B*, Waiehu Falls, South Fork of Wailua River, Kauai 38

VIII. *A*, The "Needle," Iao Valley, Maui; *B*, A recent lava flow on the Island of Hawaii 198

IX. Typical mountain streams: *A*, Wailuku River at 2,500 feet elevation, near Hilo, Hawaii; *B*, Honolii River at Kaiwiki, near Hilo, Hawaii 334

X. *A*, Cane flume and trestle across Kawainui River, near Pepeekeo, Hawaii; *B*, Weir on New Hamakua ditch at Kukuihaele, Hawaii. 346

XI. *A*, Types of rain gages: *B*, Rainfall and evaporation station at Waiakoali camp, Kauai 408

XII. Drainage map of Oahu Island, showing location of gaging and rainfall stations ..... At end of volume.

XIII. Drainage map of Kauai Island, showing location of gaging and rainfall stations ..... At end of volume.

XIV. Drainage map of Maui and Kahoolawe islands, showing location of gaging and rainfall stations ..... At end of volume.

XV. Drainage map of Hawaii Island, showing location of gaging and rainfall stations ..... At end of volume.

FIGURE 1. Diagram showing comparison of weir and current meter discharge measurements 18

2. Diagram showing fluctuation in stage of North Fork of Wailua River near Lihue, Kauai 102

3. Discharge, area, and mean velocity curves for Wailuku River near Hilo, Hawaii 339

4. Diagram showing fluctuation in stage of Honolii River at Kaiwiki, near Hilo, Hawaii 343

KAUAI

NIIHAU

KUMUKAHI CHANNEL

KAIEIE WAHO CHANNEL

OAHU

KAIWI CHANNEL

MOLOKAI

PAILOLO CHANNEL

LANAI

MAUI

KAHOOLAWE

ALENUIHAHA CHANNEL

HAWAII

PACIFIC OCEAN

SKETCH MAP

OF THE

HAWAIIAN ISLANDS

10 0 10 20 30 40 50 60 70 Miles

WATER RESOURCES OF HAWAII.

By W. F. Martin and C. H. Pierce.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams and ditches in the Territory of Hawaii made during the period 1909 to 1911, inclusive, an account of the factors that affect the flow, and a brief summary of the general conditions influencing the economic development and use of the surface waters. The investigations leading to the report were made by the United States Geological Survey in cooperation with the Territory of Hawaii, under the general sanction of the organic law of the Survey (Stat. L., vol. 20, p. 394), which contains the following paragraph:

Provided, That this officer [the Director] shall have the direction of the geological survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

As water is the most abundant and most valuable of the minerals, the investigation of water resources is authorized under the provision for examining mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911	150,000
1912	150,000
1913	150,000

The Legislature of the Territory of Hawaii approved on March 22, 1909, "An act to promote the conservation and development of the natural resources of the Territory," which provided in substance as follows: A special tax of 2 per cent shall be levied, assessed, and collected annually on all incomes in excess of $4,000; and all amounts so collected shall constitute a special fund to be expended only for the encouragement of immigration and the conservation of natural resources in the proportion of three-fourths for immigration and one-fourth for conservation. The conservation fund shall be used for the development, conservation, improvement, and utilization of the natural resources and shall be available for expenditure at such times and in such manner as a board of three persons appointed in accordance with section 80 of the organic act shall, with the approval of the governor, determine.

An act of April 26, 1911, amended the original act so as to extend it until December 31, 1913.

COOPERATION AND ACKNOWLEDGMENTS.

Under the authority conferred by the Federal and Territorial legislation, the Director of the United States Geological Survey and the Governor of the Territory of Hawaii entered into a cooperative agreement, dating from July 1, 1910, for "the gaging of streams and the determination of the water supply of the Territory of Hawaii." [1] The principal features of this agreement are:

1. The United States Geological Survey assumes the responsibility of gathering, analyzing, and publishing the data.

2. During the progress of the work all notes, maps, and data gathered as a result of field studies are at all times open to inspection by the representative of the Territory, and if they are not entirely satisfactory the agreement can be terminated.

3. Accounts for payment of salaries, travel and subsistence, supplies, or other expense necessary to the completion of the work shall be rendered in the manner required by the laws and regulations of the contracting parties, and vouchers shall be referred to either party for payment according as it may be convenient or to the balance remaining in the respective allotments.

4. The cost of publication is borne entirely by the Geological Survey.

The Territory of Hawaii has been represented in the cooperation by the board of allotment appointed by Gov. Walter F. Frear, and consisting of J. P. Cooke (chairman), Marston Campbell, and E. V. Wilcox.

[1] The United States Geological Survey is also cooperating with the Territory of Hawaii in mapping the various islands. The whole of the island of Kauai and a part of the island of Hawaii have been mapped.

The investigation of the water resources was started in November, 1909, by W. F. Martin, who represented the Geological Survey. It was carried on wholly by Territorial funds until July 1, 1910, when the Federal allotment of $5,000 annually became available. The total expenditures from both Territorial and Federal funds from November, 1909, until the end of December, 1911, the terminal date of the period covered by this report, amounted to $25,042.42, distributed as follows:

Expenditures for investigations of water resources in Hawaii.

Period.	Territorial allotment.	Federal allotment.	Total.
November, 1909, to June 30, 1910	$4,172.00		$4,172.00
July 1, 1910, to June 30, 1911	6,629.85	$5,000.00	11,629.85
July 1, 1911, to Dec. 31, 1911	6,563.20	2,677.37	9,240.57
	17,365.05	7,677.37	25,042.42

The field data were collected under the direction of W. F. Martin, district engineer, assisted by C. H. Pierce, J. B. Stewart, W. V. Hardy, H. R. Schulz, A. G. Schnack, F. B. Dodge, and Dexter Fraser. C. H. Pierce began most of the field work on Maui, particularly on East Maui and windward West Maui, and later had charge of all the field work on Hawaii. In July, 1911, J. B. Stewart and W. V. Hardy took charge of the field work on Maui and Kauai, respectively. The ratings, computations, and special estimates were made by C. H. Pierce and J. B. Stewart, assisted by W. V. Hardy and E E. Goo.

General cooperation and assistance on water resources investigations throughout the Territory have been given the Geological Survey by the following branches of the Territorial government: Public Works Department, Marston Campbell, superintendent; Public Land Department, C. S. Judd, and J. D. Tucker, commissioners; Survey Department, W. E. Wall, surveyor; and Bureau of Forestry, R. S. Hosmer, superintendent.

Acknowledgment is due to the Hawaiian section of the United States Weather Bureau, William B. Stockman, section director, for the use of rainfall records at stations maintained by the Weather Bureau, and other climatologic data.

Material assistance has also been rendered by Alexander & Baldwin (Ltd.), J. P. Cooke, president; C. Brewer & Co. (Ltd.), G. H. Robertson, manager; Castle & Cook (Ltd.), E. D. Tenney, manager; T. H. Davies & Co. (Ltd.), F. M. Swanzy, manager; H. Hackfeld & Co. (Ltd.), J. F. Hackfeld, president; Hawaiian Sugar Planters' Association, E. D. Tenney, president; Mr. C. F. Eckart; and Mr. Alonzo Gartley.

The following corporations and individuals have greatly assisted in the work by furnishing records or extending courtesies in various

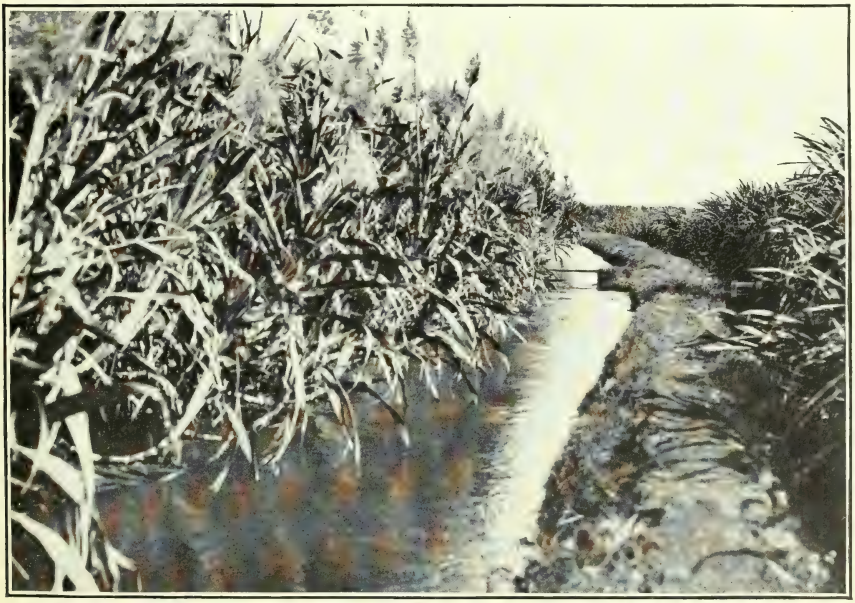
ways on the island of Kauai: Messrs. Augustus and Eric Knudsen; Kekaha Sugar Co. (Ltd.), H. P. Faye, manager; Waimea Sugar Mill Co. (Ltd.), John Fassoth, manager; Gay & Robinson; Mr. Francis Gay; Hawaiian Sugar Co. (Ltd.), B. D. Baldwin, manager; McBryde Sugar Co. (Ltd.), William Stodart and F. A. Alexander, managers; Koloa Sugar Co., C. H. Wilcox, manager; Grove Farm Plantation, E. H. W. Broadbent, manager; Rev. J. M. Lydgate; Mr. C. A. Rice; Makee Sugar Co., G. H. Fairchild and R. P. Spalding, managers; Mr. S. N. Hundley; Kilauea Sugar Plantation Co., J. R. Myers, manager; Princeville Plantation Co. (Ltd.), W. F. Sanborn, manager; and Kauai Electric Co. (Ltd.), Alfred Menefoglio, superintendent.

On the island of Oahu records of artesian water raised by pumps for use in irrigation have been given to the Geological Survey by the following sugar plantations: Honolulu Plantation Co., James Gibb, manager; Oahu Sugar Co. (Ltd.), E. K. Bull, manager; Ewa Plantation Co., G. F. Renton, manager; and Waialua Agricultural Co., W. W. Goodale, manager. These plantations, and also the Waianae Co., Frederick Meyer, manager; and the Wahiawa Water Co. (Ltd.), W. M. Templeton, manager; have kindly furnished facilities for studying the flow and efficiency of various ditch systems. Valuable records and assistance have also been furnished by Maj. W. P. Wooten and Capt. A. B. Putnam, Corps of Engineers, United States Army; the College of Hawaii, J. W. Gilmore, president; and Messrs. J. B. Castle, L. L. McCandless, E. P. Low, J. C. McMaster, E. E. Miller, T. F. Sedgwick, W. A. Wall, and William Weinrick, jr.

The following sugar plantations on the island of Maui have supplied records of water pumped for irrigation: Pioneer Mill Co., Ludwig Weinzheimer, manager; Hawaiian Commercial & Sugar Co., F. F. Baldwin, manager; and Maui Agricultural Co., H. A. Baldwin, manager. These plantations and the following have also cooperated in maintaining gaging stations or in furnishing records of flow in ditches: Wailuku Sugar Co., H. B. Penhallow, manager; Olowalu Sugar Co., George Gibb, manager; Honolua ranch, R. C. Searle and D. T. Fleming, managers. Acknowledgment is also due for assistance given and courtesies extended by Messrs. W. F. Pogue, E. Brecht, O. Brecht, Hugh Howell, W. E. Ball, Pia Cockett, A. W. Collins, F. E. Harvey, S. E. Hubbard, George Tripp, and C. J. Austin.

On the island of Hawaii the following corporations and individuals have given assistance in various ways: Kohala Ditch Co. (Ltd.), P. W. P. Bluett, superintendent; Hawaiian Irrigation Co. (Ltd.), J. T. McCrosson, manager, J. S. Low, superintendent, and Jorgen Jorgensen, engineer; B. P. Bishop Estate, F. S. Dodge, superintendent; Hilo Sugar Co., John A. Scott, manager; Albert Horner, Robert Horner, George S. Whittemore, and James Henderson.

A. RICE CULTIVATION: PREPARING FIELD FOR PLANTING.



B. SUGAR CANE AND IRRIGATION DITCH, OAHU.

A. BANANA PLANTATION NEAR HONOLULU.

B. HAWAIIAN CULTIVATING TARO.

PURPOSE AND SCOPE OF INVESTIGATIONS.

The principal industry of Hawaii is agriculture. During the fiscal year ending June 30, 1911, 98.9 per cent of the exports from Hawaii to the mainland, valued at more than $40,000,000, consisted of products of the soil.[1] Of this amount 93 per cent had been either absolutely dependent on irrigation for its growth or had required the application of water at some period in order to give the largest and most profitable yield.

Some lands are naturally adapted to the growing of rice (Pl. II, *A*), but require a dependable quantity of water, varying in amount with the stage of the crop. Sugar cane (Pl. II, *B*), by far the most important product, gives the largest yields on those lands where the proper amount of water can be applied at the right time, and large areas planted in cane depend entirely on irrigation. Taro (Pl. III, *B*), which furnishes the staple food for a considerable part of the population, requires a continual application of water during its growth.

In addition to its agricultural uses water is being demanded for mechanical purposes, such as the fluming of cane and hydro-electric developments.

With the rapidly increasing growth of the larger towns, especially Honolulu, the problem of providing water for domestic use is requiring attention. The consumption per capita is large, owing to the quantities used for irrigating lawns and gardens, but for reasons of sanitation and public health it is desirable that the use of water should not be curtailed.

The purpose of these investigations has been to obtain reliable information concerning the existing water supply, both developed and undeveloped. A point has been reached in the utilization of Hawaii's waters at which it is necessary to have definite information regarding the available sources before further progress can be made. It is well known that the limit of agricultural development in Hawaii to-day is largely determined by the possible water supply, and it is necessary either to tap new sources or else to save losses in the existing supplies, which will have the effect of increasing their economic value.

A more detailed study of the irrigation systems in the Territory is needed. In addition to investigating possible sources of supply, the total amount of water available, and means of storing the flood waters now going to waste, the work should include a study of the distribution of the water from the time it is diverted from its natural course until it is applied to the soil for beneficial use. Losses in irrigation need to be continually guarded against in order to

[1] Computed from statistics in Hawaiian Annual for 1912, p. 22.

secure the maximum results from a supply that is definitely limited, and only by making a careful study of the system as a whole can the highest efficiency be obtained.

The investigations of stream flow in the Territory are not complete, nor do they include all the streams that might advantageously be studied. They include, however, as many of the streams and ditches on the four larger islands as the available appropriations would allow. It is essential that records of stream flow should be kept during a period of years long enough to determine within reasonable limits the range of flow from the maximum to the minimum. The length of such a period manifestly varies for different streams. Experience has shown that the records should be kept from 5 to 20 years.

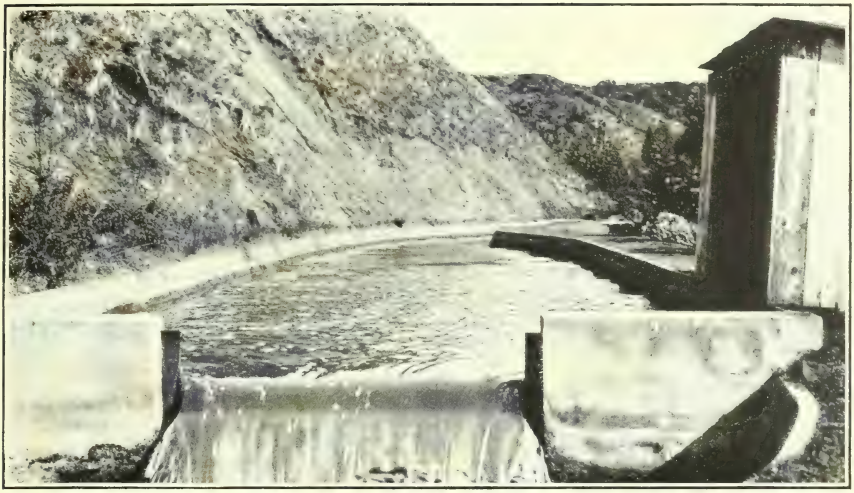
In the performance of this work an effort is made to reach the highest degree of precision possible with a rational expenditure of time and money. In all engineering work there is a point beyond which refinement is needless and wasteful, and this statement applies with especial force to stream-measurement work in Hawaii. It has been found, however, that it is possible to obtain data which are sufficiently accurate, although many of them presented in this report are for periods too short to admit of definite conclusions.

Records have been obtained at about 200 different points in the Territory, and in addition to the observations at the regular stations, miscellaneous measurements at many other places have been made. Records have also been collected regarding precipitation on areas drained by the principal streams and at a number of points in the mountains at high elevations. Evaporation losses have been studied and data obtained at various places where such losses are serious.

FIELD METHODS OF MEASURING STREAM FLOW.

BASE DATA.

In making plans for power, irrigation, municipal water supply, and other projects involving the use of water from surface streams, it is necessary to have data from which both the total flow of the stream and its distribution from day to day throughout the year can be obtained. The data necessary for obtaining such information are daily gage heights, which give the fluctuations of rise and fall of the stream, and measurements of discharge at various stages, from which a rating curve and table can be prepared, giving the discharge for any stage. Such a rating is possible from the fact that so long as the conditions at the controlling point in the stream remain the same, there will be the same discharge for any given gage height.



A. WEIR GAGING STATION, WAHIAWA RESERVOIR DITCH, OAHU.

B. VELOCITY-AREA GAGING STATION, WAIAHOLE STREAM, OAHU.

Measurement by wading.

TYPES OF GAGING STATIONS.

The determination of a discharge is termed a discharge measurement and points at which discharge measurements are made and records of daily fluctuations of stage are kept for determining the daily flow are termed gaging stations.

Gaging stations may be divided into two classes, known as weir stations and velocity-area stations. (See Pl. IV.) At weir stations the head of water on the crest of the weir is measured and the discharge computed by means of a formula. The discharge at velocity-area stations is obtained by measuring the velocity of the current and the area of the cross-section, the product of the two giving the discharge.

The data presented in this paper were collected at both weir and velocity-area stations.

WEIR MEASUREMENTS.

Unquestionably a weir properly constructed and of a type for which accurate coefficients have been determined is one of the most convenient and reliable means of measuring small quantities of water. In practice, however, weirs rarely conform to the requirements imposed by the experimenter who derived the coefficients. If the crest of the weir is sharp and clean and sufficiently high above the bottom of the leading channel and the end contractions are complete and the velocity of approach is wanting, or negligibly small, and if the head on crest is measured at a distance of 6 or 8 feet back of the overfall, the Francis formula will give good results. On the other hand, if these essential conditions are not complied with, especially if the velocity of approach is considerable, and the contractions are imperfect, the Francis formula will not give accurate results. This is particularly true if the weir is improperly constructed and there is leakage around and under it, as is so frequently the case in practice.

Observations made on various types of weirs in Hawaii show that of the weirs in use in the Territory not all are giving accurate results. If the error is known so that corrections can be made the trouble is largely mitigated, but faulty weir records are too often accepted without investigation as to their accuracy.

The following examples are cited to show some of the difficulties encountered in the use of weirs:

A small timber weir built by the Geological Survey in the mountains back of Honolulu gave so much trouble by leaking that current-meter measurements were finally made to obtain a discharge rating.

The effect of wave action caused by velocity of approach is shown by an important measuring weir on Oahu. This weir is exceptionally well built, having good end contractions and an unusually large approach channel, but the discharge as computed by the weir formula

is from 6 to 10 per cent too small, the percentage of error being greater at the lower heads. The trouble is caused by wave action in the pool, due to the inflow of water under pressure.

A 25-foot Cippoletti weir on Maui shows an error of 8 to 10 per cent in the discharge at ordinary stages. In this case the percentage of error increases rapidly with the head above a head of 0.6 foot. Another weir on Maui, used as a division weir between two important ditches, gives a discharge, as computed by the weir formula, which is from 11 to 23 per cent too small, the error increasing rapidly with the higher heads. (See fig. 1.) It should be stated that these two weirs

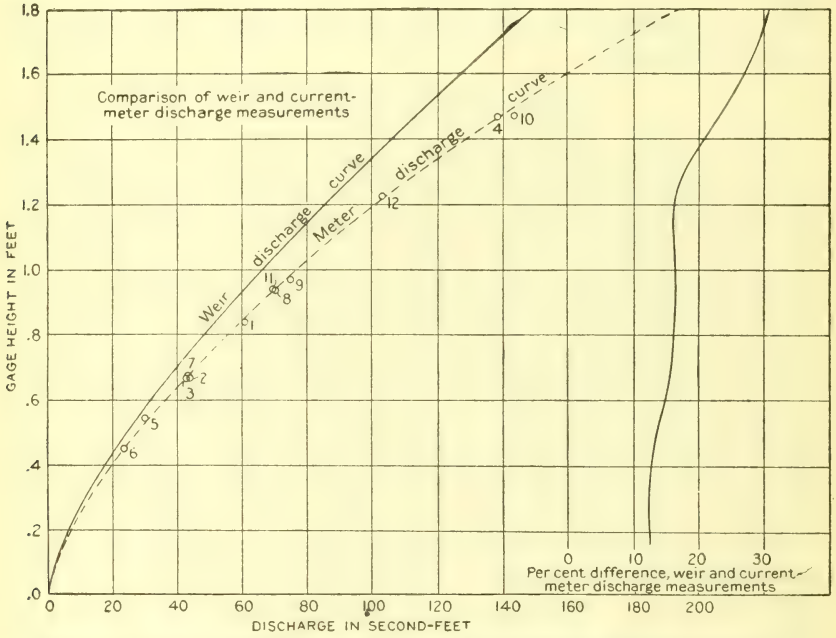
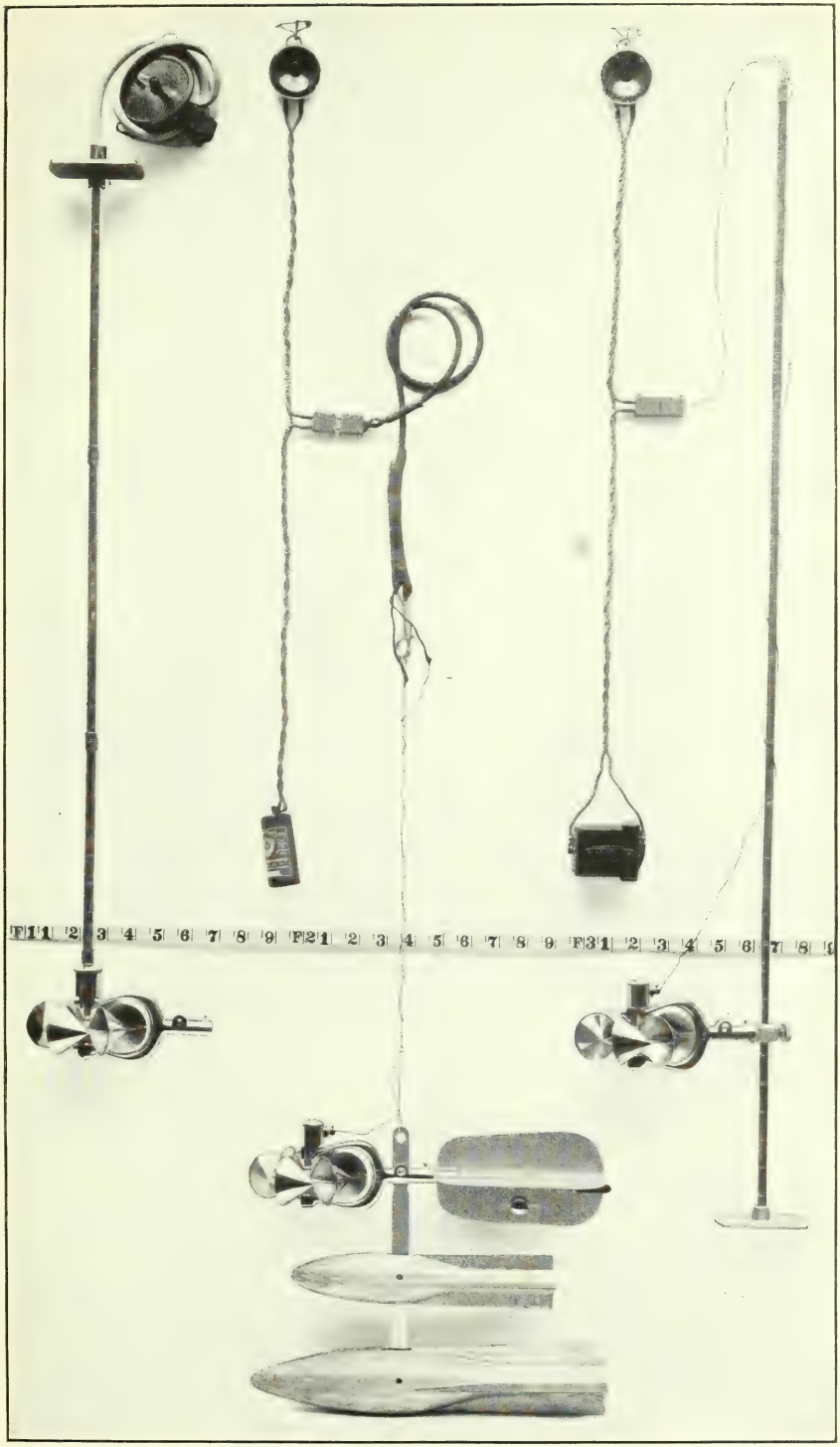


FIGURE 1.—Diagram showing comparison of weir and current-meter discharge measurements.

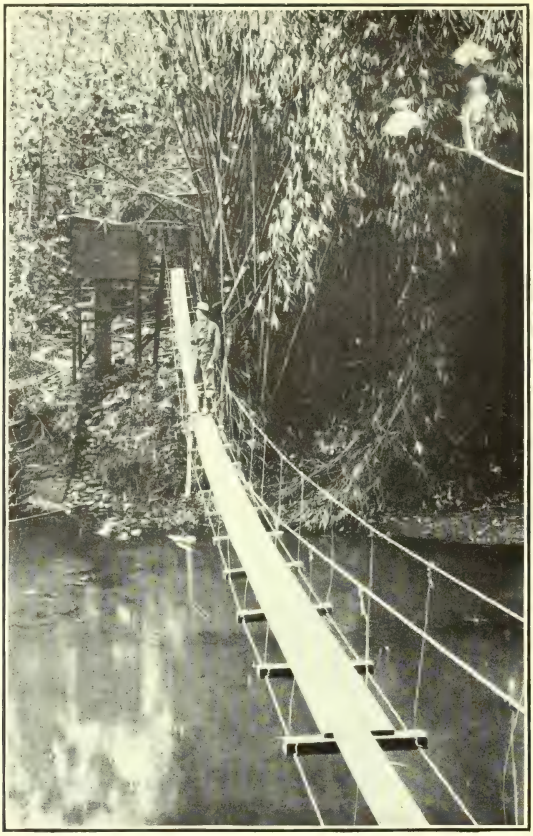
are in gulches, where the conditions for weir construction are far from ideal.

If a weir is in error, the result is usually that the discharge as computed by the Francis formula is less than the actual discharge. Two Cippoletti weirs, however, showed for low heads a discharge by formula greater than the actual, while at higher heads the opposite was true.[1]

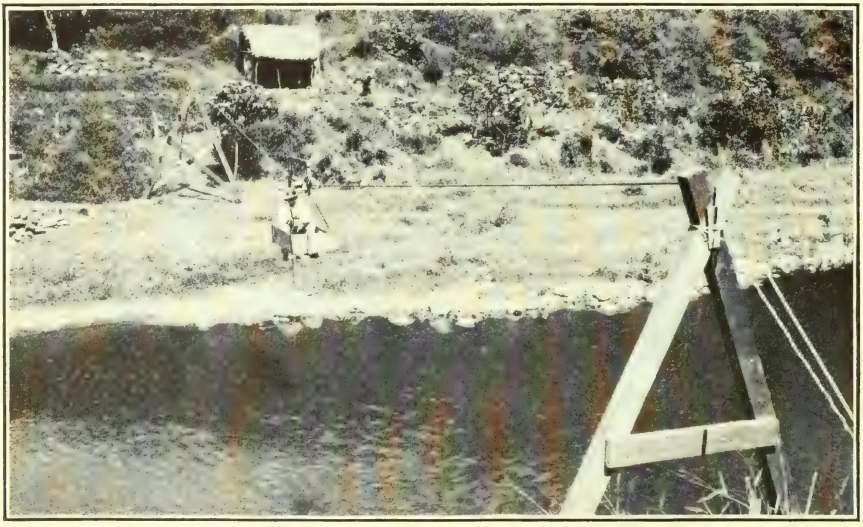
[1] The determination of discharge over the different types of weirs and dams is treated fully in "Weir experiments, coefficients, and formulas" (Water-Supply Paper 200) and in the various textbooks on hydraulics. "Turbine water-wheel tests and power tables" (Water-Supply Paper 180) treats of the discharge through turbines when used as meters. The edition of Water-Supply Paper 200 is exhausted. It can, however, be consulted at most of the larger libraries of the country or it can be obtained from the superintendent of documents, Washington, D. C., at a cost of 35 cents.



SMALL PRICE CURRENT METERS.



A. BRIDGE STATION ON NORTH FORK OF WAILUA RIVER, KAUAI.



B. CABLE STATION ON HANAPEPE RIVER, KAUAI.

TYPICAL GAGING STATIONS.

VELOCITY-AREA METHOD.

The velocity-area method of measurement consists of determining the mean or average velocity of the water past a given cross-section area. The area of the cross section at right angles to the direction of flow is determined by soundings which are taken at such distances apart as will develop the contour of the stream bed. The depths are recorded and also their distances from some arbitrarily chosen initial point on one side of the stream.

The method of making the soundings depends on the size and stage of the stream. On ditches and small streams where the depths and velocities are not large, a graduated rod may be used to advantage; on large streams, which must be measured from bridges or cables, a lead weight and sounding line must be used. The weights are of different sizes—6½, 10, or 15 pounds—according to the swiftness of the current, and are torpedo shaped, so as to offer as little resistance as possible to the moving water. (See Pl. VI.)

On streams with beds which are permanent or nearly so, like the South Fork of Wailua River on the island of Kauai and the Wailuku River on the island of Hawaii, a standard cross section is usually constructed from careful soundings and referred to the zero of the gage, so that the depths for any stage can be found by adding the gage height at that stage to the depths below the zero of the gage. This method is especially useful at high stages, where it is difficult to make accurate soundings.

After the cross-section area of the stream has been measured by soundings and horizontal distances, the velocity is determined at a number of points. These measurements of velocity should be made at frequent intervals across the stream and close enough to take account of any abrupt change in the velocity. For convenience, the velocities are usually observed in the same verticals at which soundings are made. On some streams fairly good measurements of velocities may be made by means of subsurface floats. This method is applicable, however, only to channels of uniform cross-section area over a considerable distance and is very unsatisfactory for use on natural streams like those of Hawaii.[1]

The velocity of flow is best determined by the current meter, which is a form of water wheel actuated by the current, and of such size and shape that it can easily be placed at any point in the stream.[2] (See Pl. V.)

Plate V shows in the center the new type of penta-recording current meter equipped for measurements at bridge and cable stations; on

[1] Further information regarding the float method is given in Water-Supply Paper 95 and in textbooks on stream flow.

[2] See Hoyt, J. C., and others, Use and care of the current meter as practiced by the United States Geological Survey: Trans. Am. Soc. Civil Eng., vol. 66, 1910, p. 70.

the left the same type of meter is shown equipped for wading measurements, to record by the acoustic method; on the right the meter is shown equipped to record electrically. Briefly, the meter consists of six cups attached to a vertical shaft which revolves on a conical hardened steel point when immersed in moving water. The revolutions are indicated electrically. The rating, or relation between the velocity of moving water and the revolutions of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity in feet per second of moving water for any number of revolutions in a given time interval. The ratio of revolutions per second to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity curve method. It is very extensively used in the regular practice of the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from unity in individual cases is, however, greater than in the 0.2 and 0.8 method and the general results are not as satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be in general from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or for measurements when the velocity is so great that the meter can not be kept in the correct position for the other methods.

The vertical integration method consists in moving the meter at a slow but uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity determination.

In practical work on rough streams, such as exist in Hawaii, the meter should be held at 0.6 depth for depths of 0.8 or less. For greater depths the meter should be held at two points in the vertical, 0.2 and 0.8 from the surface.

When the mean velocities in the different verticals have been found, the average of two adjacent means is taken as the mean velocity for that individual section. The area of the section is computed by multiplying the width of the section by the mean depth. The discharge of each section is then the product of the area multiplied by the mean velocity, and the total discharge of the stream results

from summing up the discharge of the individual sections. In practice the work is tabulated in such a way as to render the computation very simple.[1]

Current meter measurements are not practicable where there are eddies, cross currents, swirls, or passages for the water underneath stones. It is usually possible, however, to improve the channel by removing bowlders and rocks, so that a satisfactory measuring section may be obtained, even on rough steep streams such as exist in Hawaii.

Three kinds of velocity-area gaging stations are in general use in Hawaii, according to the means provided for making the observations of depth and velocity. They are wading, bridge, and cable stations.

A wading station is one at which measurements are made only by wading—that is, no means exist for getting above the water at any stage except by wading. Such stations are usually on ditches or wide, shallow streams, which do not fluctuate greatly in flow. Frequently, however, measurements are made at low stages by wading even though other means exist for making measurements at higher stages. (See Pl. IV, *B*.)

A bridge station is one at which the meter is used from a bridge. In some places highway or other bridges are available from which to make measurements, but generally they are not at the right place on the stream. Special bridges are then built. (See Pl. VI, *A*.)

A cable station is one at which measurements are made from a cable spanning the stream. Cable stations are used on large streams, such as Hanapepe, Wailua, and Hanalei rivers on the island of Kauai, and Wailuku River on the island of Hawaii. The cable supports the car from which a man works above the water. Distances are marked off on the cable itself or on a small auxiliary cable stretched taut above it. (See Pl. VI, *B*.)

A suitable place for a gaging station having been selected, a staff gage is set in the edge of the stream, either vertical or inclined, but graduated into tenths of feet vertically. The gage is securely fastended to rocks or trees to prevent displacement by floods and is so placed that the zero, or reference datum, is well below extreme low water. The datum is also referred to a permanent bench mark as an additional precaution. An observer is then engaged to record the heights of water morning and evening; the mean of the two readings being used as the mean gage height for the day.

Owing to the rapid rise and fall of most of the streams in Hawaii, two gage-height readings a day will not as a rule give a true mean for the 24 hours. For this reason, and also owing to the fact that many of the gaging stations are necessarily situated in the mountains at

[1] For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.

points remote from all habitations and difficult of access, the use of automatic recording gages has been found to be generally necessary. The gages used are of various types, some requiring weekly visits and others operating for a month without attention.

The essential features of automatic gages consist of a float free to rise and fall with fluctuations of the water surface, a means of transferring this motion of the float to the record, either directly or through a reducing mechanism, the recording device, and the clock. In most gages used on natural streams the float is connected with a counterweight by means of a chain or perforated tape which passes over a sprocket wheel connected with gearing in such a way as to reduce the motion caused by the rise and fall of the water surface to a convenient scale. This vertical motion from the float may be transferred either to the pencil or other recording device or to the cylinder carrying the paper. The time interval is given by the clock, which may move either the paper or the pencil, according to the float connection. For all autographic records the motions controlled by the float and the clock are brought at right angles so that there results a continuous curve where one set of ordinates represents gage heights, and the other the time interval.

The gage may be designed to accommodate any range of stage. Those used by the United States Geological Survey in Hawaii are designed for variations of 10, 20, 30, and 36 feet, but so far those having a 20-foot range have been found to be sufficient for any stage.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated more or less definitely with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as "second-feet," "gallons per minute," "gallons per 24 hours," "miner's inches," and "run-off in second-feet per square mile," and (2) those which represent the actual quantity of water, as "run-off in depth in inches," "million gallons," and "acre-feet." They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the unit for the rate of discharge of water flowing in a stream 1 square foot in cross section at a rate of 1 foot per second. It is generally adopted as the fundamental unit in the measurement of flowing water and is the "natural" unit, as the foot and the second are the units used in making the physical determinations. Other units may be computed from this by the use of factors given in the table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply, the United States gallon of 231 cubic inches being the unit of quantity and 1 minute the unit of time.

The "miner's inch" is the unit for the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot" is equivalent to 43,560 cubic feet and is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

In the Territory of Hawaii a unit commonly used in connection with the measurement of water is the "million gallons." This is used with two meanings—(1) to indicate a rate of flow and (2) to express an actual quantity of water. In the former sense "million gallons per 24 hours" is inferred, 1,000,000 gallons being taken as the unit of quantity, and 24 hours as the unit of time. With this meaning the term is generally used in connection with pumping and irrigation. In the latter sense "million gallons" as an absolute quantity is used in the measurement of storage capacities of reservoirs.

The following convenient approximate relations exist between second-feet, million gallons per 24 hours, and acre-feet: 1 second-foot flowing 24 hours equals about 2 acre-feet; 1,000,000 gallons equals about 3 acre-feet; and 1 second-foot equals approximately two-thirds million gallons per 24 hours.

"Man's water" is an irrigator's term also in common use in Hawaii. It signifies the amount of water that one irrigator can properly handle in the field. It varies greatly, being dependent upon the condition of the furrows, the age of the crop, and the skill and individuality of the irrigator. Some measurements indicate that it is about 0.75 second-foot. It may be almost any quantity under 1 second-foot.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For partial month multiply values for one day by the number of days.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.

1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.

1 second-foot for one year equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day covers 1 square mile 0.03719 inch deep.

1 second-foot for one day equals 1.983 acre-feet.

1,000,000 United States gallons per day equals 1.55 second-feet.

1,000,000 United States gallons equals 3.07 acre-feet.

1,000,000 cubic feet equals 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.

1 inch deep on 1 square mile equals 2,323,200 cubic feet.

1 inch deep on 1 square mile equals 0.0737 second-foot per year.

1 foot equals 0.3048 meter.

1 mile equals 1.60935 kilometers.

1 mile equals 5,280 feet.

1 acre equals 0.4047 hectare.

1 acre equals 43,560 square feet.

1 acre equals 209 feet square, nearly.

1 square mile equals 2.59 square kilometers.

1 cubic foot equals 0.0283 cubic meter.

1 cubic foot equals 7.48 gallons.

1 cubic foot of water weighs 62.5 pounds.

1 cubic meter per minute equals 0.5886 second-foot.

1 horsepower equals 550 foot-pounds per second.

1 horsepower equals 76.0 kilogram-meters per second.

1 horsepower equals 746 watts.

1 horsepower equals 1 second-foot falling 8.80 feet.

1½ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11} = \text{net horsepower on water wheel realizing 80 per cent of theoretical power.}$

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of daily gage heights, discharge measurements, and notes from observers' books are assembled. The measurements are plotted on cross-section paper and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharge, and from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the class of channels which they represent. (See fig. 3, p. 339.) The discharge measurements for all classes of stations, when plotted with gage heights in feet as ordinates and discharges in second-feet as abscissas, define rating curves which are generally more or less parabolic in form. For many stations curves of area in square feet and mean velocity in feet per second are also constructed to the same scale of ordinates as the discharge curve. These are used mainly to extend the discharge curves beyond the limits of the plotted discharge measurements, to check the form of the discharge curve, and to determine and eliminate erroneous measurements.

For every rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating, as stated in the footnote of each table, is not applicable for periods during which the channel was obstructed; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock and is not subject to the deposit of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean discharge curve, and the rat-

ing developed from that curve represents a very high degree of accuracy.

Class 2 comprises mainly stations on rough, mountainous streams with steep slopes. The beds of such streams are, as a rule, comparatively permanent during low and medium stages, and when the flow is sufficiently well defined by an adequate number of discharge measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the few days of highest gage heights covering the period of actual change in conditions of flow.

Class 3 includes those stations where the stream bed is of a shifting character, or the controlling section below the gage frequently changes owing to cutting out by the current and the filling in of sand, gravel, and drift. In some cases in Hawaii changes are caused by the growth of vegetation in the stream bed. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of the current year, the engineer being guided largely by the history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve which may be called a standard curve. It has been found in practice that if after a change caused by high stage a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to ordinates or gage heights. This law of the parallelism of rating curves is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct, but, with few exceptions, answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is, of course, fundamentally due to change in the channel caused by cut or fill, or both, at or near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section there would result, other conditions of flow being equal, new curves of discharge, area, and

velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) In the case of a cut or fill at the measuring section there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect, and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) In the case of uniform change along the crest of a weir or rocky control the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

Of course, in actual practice such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another, and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of rating curves. In complicated changes of section the corresponding changes in velocity which tend to produce a new parallel discharge curve may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes at low or medium stages of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve, the results are considered good for stations of this class.

Class 4 comprises stations on streams that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency ranging from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement.

For days between successive measurements it is assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases.

The computations have as a rule been carried to three significant figures. Computation machines and the 20-inch slide rule have been generally used. All computations are carefully checked.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as feasible, by means of comparison with records for adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the daily and monthly discharge tables.

EXPLANATION OF TABLES.

For each drainage basin there is given a brief general description covering such items as area, topography, source, tributaries, forestation, rainfall, irrigation, and other features of interest and importance. For each regular current-meter gaging station are given in general the following data: Description of station, list of discharge measurements, table of daily gage height, table of daily discharge, table of monthly and yearly discharge, and run-off in acre-feet. For stations located at weirs or dams the gage-height table is omitted.

All rates of flow are expressed as second-feet, because distances and depths are measured in feet, and velocities in feet per second. The flow is thus obtained in cubic feet per second, or more briefly in "second-feet." The term "million gallons per 24 hours" is not used except in a few tables where the results of pumping stations have been given in million gallons as well as second-feet. "Million gallons per 24 hours" is not a primary but a derived unit. To convert second-feet into million gallons per 24 hours divide by 1.55.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as shifting channels and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of

hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage height records the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening unless a continuous record is obtained by means of an automatic instrument. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights affected by shifting conditions of flow or by backwater from obstructions are published as recorded, with suitable footnotes. The rating table is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report, but can be determined from the daily gage heights and daily discharges, for the purpose of verifying the published results as follows:

First plot the discharge measurements on cross-section paper with gage height in feet as ordinates and discharge in second-feet as abscissas. Then tabulate a number of gage heights taken from the daily gage-height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be prepared by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant, except for known conditions of backwater.

The table of daily discharge gives the discharge in second-feet corresponding to the observed gage height as determined from the rating table, the number of significant figures used varying with the size of the discharge. For quantities below 0.5 second-foot the daily discharge is carried to hundredths; from 0.5 to 9.9 second-feet, to tenths only; from 10 to 99 second-feet all decimals are omitted, and above 100 second-feet only three significant figures are used.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height, and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 24, are based.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favorably with the results from standard weirs, and, owing to simplicity of methods, usually gives results that are much more reliable than those from the ordinary weir used under conditions widely different from those under which the weir formula was derived.

The work is, of course, dependent on the reliability of the observers. With relatively few exceptions, the observers perform their work honestly. Care is taken, however, to watch them closely and to inquire into any discrepancies. It is, of course, obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables "well defined" indicates in general that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

GAGING STATIONS MAINTAINED IN HAWAII.

The following list comprises the gaging stations maintained in Hawaii by the United States Geological Survey and cooperative parties. The stations are arranged by stream basins and appear in systematic order for the several islands, tributaries of main streams being indicated by indention. The date refers to the years or parts of years for which records are available. (See Pls. XII–XV, at end of volume.)

KAUAI ISLAND.

Waimea River near Waimea, 1909–1911.
- Poomau River:
  - Kawaikoi Stream near Waimea, 1909–1911.
    - Waiakoali Stream near Waimea, 1909–1911.
  - Mohihi Stream near Waimea, 1909–1911.
- Waialae Stream near Waimea, 1910–11.
- Kekaha ditch at intake near Waimea, 1910–11.
- Kekaha ditch at flume No. 3, near Waimea, 1910–11.
- Kekaha ditch at siphon, near Waimea, 1910–11.
- Kekaha ditch at tunnel No. 12 weir, near Waimea, 1910–11.
- Waimea ditch near Waimea, 1911.
- Kamenehune ditch near Waimea, 1911.
- Makaweli River near Waimea, 1911.
  - Olokele River:
    - Olokele ditch at tunnel No. 12, near Makaweli, 1910–11.
  - Poowaiomahaihai ditch near Waimea, 1911.

Hanapepe River at Hanapepe Falls, near Eleele, 1911.
Hanapepe River at Kaula, near Eleele, 1910–11.
- Hanapepe ditch at Hanapepe Falls, near Eleele, 1911.
- Hanapepe ditch at Kaula, near Eleele, 1910–11.
- Hanapepe ditch at weir, near Makaweli, 1910–11.
- Hiloa Stream at Hanapepe Falls, near Eleele, 1911.
  - Hiloa ditch at Hanapepe Falls, near Eleele, 1911.

Hanamaula River at Kapai, near Lihue, 1911.
Wailua River:
- South Fork of Wailua River at siphon, near Lihue, 1910–11.
- South Fork of Wailua River above Waiehu Falls, near Lihue, 1911.
  - Lihue ditch near Lihue, 1910–11.
  - Hanamaulu ditch near Lihue, 1910–11.
- North Fork of Wailua River near Lihue, 1910–11.
  - Kanaha ditch near Lihue, 1910–11.

Konohiki Stream at Makakualele weir, near Kapaa, 1911.
Kaehulua Stream at Kainahola (mule stable) weir, near Kapaa, 1911.
Kaehulua Stream at Wainamuamu weir, near Kapaa, 1911.
Kaehulua Stream at Kuhinoa weir, near Kapaa, 1911.
Kapaa River at Kapahi, near Kapaa, 1910–11.
Akulikuli Springs near Kapaa, 1909–1911.
Kapahi ditch at Kapahi, near Kapaa, 1909–1911.
Tunnel ditch at Kapahi, near Kapaa, 1909–1911.
Kapaa ditch at Kapahi, near Kapaa, 1909–1911.
Pipe ditch at Kapahi, near Kapaa, 1909–1911.
Kealia Stream:
Kaneha ditch at Kaneha, near Kealia, 1907–1911.
Anahola River above dam at Kiokala, near Kealia, 1910.
Anahola River at Kiokala dam, near Kealia, 1910–11.
Anahola ditch at Kiokala, near Kealia, 1909–1911.
Anahola ditch at makai weir, near Kealia, 1909–1911.
Hanalei River near Hanalei, 1911.
China ditch near Hanalei, 1911.
Wainiha River at power house, near Wainiha, 1911.
Wainiha canal at intake, near Wainiha, 1910–11.
Wainiha canal at tunnel No. 18, near Wainihi, 1911.
Wainiha canal at tailrace, near Wainiha, 1911.

OAHU ISLAND.

Palolo Stream:
Waiomao Stream at 950-foot elevation, near Honolulu, 1911.
Waiomao Stream at bridge above Pukele Stream, near Honolulu, 1911.
Manoa Stream at upper end of valley, near Honolulu, 1910–11.
Manoa Stream at College of Hawaii, near Honolulu, 1909–10.
Manoa Stream at Waialae Road, near Honolulu, 1910–11.
Pauoa Stream below Kahuawai Springs, near Honolulu, 1911.
Nuuanu Stream at Kuakini Street, Honolulu, 1911.
Lulumaho ditch in Nuuanu Valley, near Honolulu, 1911.
Luakaha weir in Nuuanu Valley, near Honolulu, 1910–11.
Kaukonahua Stream:
South Fork of Kaukonahua Stream near Wahiawa, 1911.
North Fork of Kaukonahua Stream near Wahiawa, 1911.
Wahiawa Reservoir ditch near Wahiawa, 1910–11.
Kaipapau Stream near Hauula, 1906–7.
Kaluanui Stream near Hauula, 1906–7.
Punaluu Stream near Hauula, 1906–7.
Waiahole Stream at Manianiaula, near Waikane, 1911.
Waiahole Stream at Waiahole, near Waikane, 1911.
Waihi Stream near Waikane, 1911.
Halona Stream near Waikane, 1911.
Waianu Stream near Waikane, 1911.

MAUI ISLAND.

Waihee Stream near Waihee, 1910–11.
Waihee canal near Waihee, 1910–11.
Waihee canal at weir near Wailuku, 1911.
Spreckels ditch near Waihee, 1910–11.
Spreckels ditch at Waiale weir, near Wailuku, 1910–11.

Waiehu Stream:
North Waiehu Stream near Wailuku, 1911.
North Waiehu ditch near Wailuku, 1910–11.
South Waiehu Stream near Wailuku, 1910–11.
Iao Stream near Wailuku, 1910–11.
Maniania ditch near Wailuku, 1910–11.
Waikapu Stream near Waikapu, 1910–11.
South Side Waikapu ditch near Waikapu, 1910–11.
Palolo (Everett) ditch near Waikapu, 1910–11.
Ukumehame Stream near Olawalu, 1911.
Olowalu Stream:
Olowalu ditch No. 1 near Olowalu, 1911.
Launiupoko Stream near Lahaina, 1911.
Kauaula Stream near Lahaina, 1911.
Kauaula weir No. 1 near Lahaina, 1901.
Kauaula weir No. 2 near Lahaina, 1901.
Kauaula weir No. 3 near Lahaina, 1901.
Lahainaluna Stream near Lahaina, 1911.
Lahainaluna weir No. 1 near Lahaina, 1901.
Lahainaluna weir No. 2 near Lahaina, 1901.
Kahoma Stream near Lahaina, 1911.
Kahoma Stream at weir No. 1, near Lahaina, 1901.
Kahoma Stream at weir No. 2, near Lahaina, 1901.
Kahoma ditch at weir near Lahaina, 1911.
Honokawai Stream near Lahaina, 1911.
Honokawai weir No. 1 near Lahaina, 1901.
Honolua Stream near Honokohau, 1911.
Honolula ditch near Honokohau, 1911.
Honokahau Stream near Honokahau, 1911.
Honokahau ditch at intake, near Honokahau, 1907–1911.
Honokahau ditch above Honolua Stream, near Honokahau, 1910–11.
Honokahau ditch at Honokawai weir, near Lahaina, 1910–11.
Koolau ditch region:
Koolau ditch near Keanae, 1910–11.
Koolau ditch at Alo division weir, near Huelo, 1908–1911.
Spreckels ditch region:
Haipuaena Stream near Huelo, 1910–11.
Puohakamoa Stream near Huelo, 1910–11.
Alo Stream near Huelo, 1910–11.
Waikamoi Stream near Huelo, 1910–11.
Oopuola Stream near Huelo, 1910–11.
Spreckels ditch at station No. 1, near Huelo, 1910–11.
Spreckels ditch at station No. 2, near Huelo, 1911.
Spreckels ditch at station No. 3, near Huelo, 1910–11.
Spreckels ditch at station No. 4, near Huelo, 1910–11.
Spreckels ditch at station No. 5, near Huelo, 1911.
Spreckels ditch at station No. 6, near Huelo, 1911.
Spreckels ditch at station No. 7, near Huelo, 1911.
Spreckels ditch at station No. 8, near Huelo, 1911.
Center ditch region:
Center ditch near Huelo, 1910–11.

Hamakua ditch region:
Nailiilihaele Stream near Huelo, 1910–11.
Kailua Stream near Huelo, 1910–11.
Oanui Stream near Huelo, 1910–11.
Hoolawaliilii Stream near Huelo, 1910–11.
Hoolawanui Stream near Huelo, 1910–11.
Honopou Stream near Huelo, 1910–11.
Halehaku Stream at dam, near Huelo, 1910–11.
Halehaku Stream weir near Huelo, 1910–11.
Opana Stream near Huelo, 1910–11.
Opana ditch near Huelo, 1910–11.
New Hamakua ditch at Nailiilihaele weir, near Huelo, 1910–11.
New Hamakua ditch at Halehaku weir, near Huelo, 1910–11.
Old Hamakua ditch at Opana weir, near Huelo, 1910–11.
Kaluanui ditch at Puuomalei, near Hamakuapoko, 1910–11.
Lowrie ditch at Opana weir, near Huelo, 1910–11.
Haiku ditch at Peahi weir, near Huelo, 1910–11.

HAWAII ISLAND.

Hilo group:
Wailuku River near Hilo, 1911.
Honolii River at Kaiwiki, near Hilo, 1911.
Honolii ditch at Kaiwiki, near Hilo, 1911.
Kawainui River at Kawainui, near Pepeekeo, 1911.
81 stations at 2,500 feet elevation, near Hilo, 1911.

Hamakua group:
Waipio River below Koiawe, near Waipio, 1911.
Waipio River below Waima, near Waipio, 1911.
Waipio River at 360 feet elevation, near Waipio, 1901–2.
Kawainui of Waipio River, near Waipio, 1911.
Kawainui Stream at 2,120 feet elevation, near Waipio, 1901–2.
Kawainui Stream at 1,435 feet elevation, near Waipio, 1901–2.
Kawainui Stream at 775 feet elevation, near Waipio, 1901–2.
Branch No. 3 of Kawainui Stream at 1,700 feet elevation, near Waipio, 1901–2.
Branch No. 2 of Kawainui Stream at 1,405 feet elevation, near Waipio, 1901–2.
Branch No. 1 of Kawainui Stream at 1,380 feet elevation, near Waipio, 1901–2.
Alakahi Stream at 1,200 feet elevation, near Waipio, 1901–2.
Alakahi Stream at 730 feet elevation, near Waipio, 1901–2.
Koiawe Stream at 1,120 feet elevation, near Waipio, 1901–2.
Koiawe Stream at 610 feet elevation, near Waipio, 1901–2.
Waima Stream at 790 feet elevation, near Waipio, 1901–2.
Waima Stream at 385 feet elevation, near Waipio, 1901–2.

Kohala group:
Honokane Stream:
East Branch of Honokane Stream at 1,300 feet elevation, near Honokane, 1901.
East Branch of Honokane Stream at 770 feet elevation, near Honokane, 1901.
West Branch of Honokane Stream at 1,370 feet elevation, near Honokane, 1901.
West Branch of Honokane Stream at 775 feet elevation, near Honokane, 1901.
Kohala ditch near Kohala, 1910–11.

ISLAND OF KAUAI.

GENERAL FEATURES.

Kauai is the smallest of the four large islands, and lies at the northwest end of the main group. (See Pl. I.) It is separated from Oahu on the southeast by the Kaieie Waho Channel, the width of which is 63 sea miles, and its nearest landing, Nawiliwili, is 98 sea miles from Honolulu. (See Pl. XIII, at end of volume.)

On the map Kauai appears approximately circular in outline, but its greatest length east and west—that is, from Mana to Anahola—is about 32 miles, while its width, north and south, from Hanalei to Hanapepe, is only about 22 miles. Its area is 547 square miles, which is somewhat less than one-half that of Rhode Island. Its shore line is fairly regular, and there are not many bays or capes. Hanalei on the north and Nawiliwili on the southeast are the two principal bays. The water is deep near the shore, and there are few coral reefs. It is probable, however, that the coastal plain, which extends around a large part of the island, is the result of wash from the highlands which has been deposited between the old shore line and coral reefs that may have existed originally. Mana Flat on the west, which is 2 or 3 miles wide and stretches westward about 10 miles from Waimea, appears to be due to wash which has been deposited on uplifted coral beds.

The highest part of Kauai consists of the mountain mass called Waialeale, which occupies the central part of the island. Waialeale Peak is 5,080 feet above sea level. Kawaikini Peak, about 1 mile farther south, is 90 feet higher. From the region of these peaks the slope is rapid in every direction, being more precipitous, however, toward the east.

Three important ridges, or divides, branch off from Waialeale and thus determine the course of the streams. One of these ridges extends toward the northeast through peaks back of Kealia and along the crest of the Anahola Mountains to the sea. The other two constitute the main divide or backbone of the island, which, starting at the southeast, follows along the Haupu Ridge east of Koloa across the Koloa-Lihue Gap and then northward along the ridge east of Hanapepe basin to the summit, where it turns slightly to the northwest along the western edge of the Wainiha basin to the sea. Another important divide leaves the main one at Kilohana north of Alakai Swamp, and follows westward along the Kaunuohua Ridge, and then southward along the western edge of Waimea Canyon to the sea. These watersheds mark out four distinct drainage areas or basins.

The western area includes Napali (the precipices) on the northwest, and that part of the island west of Waimea Canyon. It consists for the most part of open rolling country sloping to the west from

Waimea Canyon, and intersected by numerous gulches which are practically dry except for a few hours after storms. Along the northwest coast, however, there are several short streams which issue from the deep, narrow canyons that lie among the cliffs of this region.

The southern basin comprises about one-third of the island and includes all the streams west and south of the main divide. The northern part of the area is comparatively flat and is of a swampy nature. There are numerous streams, all of which rise on the western slope of the divide at or near the crest and flow westward or southward. Most of them have cut deep channels, some of which are veritable canyons, which extend far back from the sea and are separated by narrow ridges. The Waimea Canyon is especially noteworthy. It is about 10 miles long, a mile or more wide, and 2,000 to 3,000 feet deep. Its coloring and sculpturing are exquisite, and remind one of the Grand Canyon of the Colorado. Practically all the run-off from this basin reaches the sea through Waimea, Makaweli (Olokele), and Hanapepe Rivers. The eastern basin includes all streams east of the main divide and south of the Waialeale-Anahola divide. The greater part of this area is more or less open and comparatively flat, having been leveled by erosive agencies for a considerable distance back from the sea. The general slope is comparatively light except near the crest of the divide, where it is very steep. The east side of Waialeale is almost vertical for a depth of 2,000 to 3,000 feet. The general slope has been somewhat modified by Kalepa Ridge on the east, 600 to 700 feet high and 5 miles long, through which Wailua River has cut its channel; and by Kilohana Crater west of Lihue, a tufa cone 1,134 feet in height which was thrown up after the general drainage lines had been formed. The run-off from this basin reaches the sea chiefly through the following streams: Huleia, Kapaia, North and South Wailua, Kapaa, and Anahola.

The northern basin is somewhat triangular in shape and includes all streams going to sea between Anahola on the east and Napali on the west. This basin is characterized by several long, narrow ridges radiating northward from Waialeale and separating deep gulches that carry good-sized streams. The eastern part of the basin is comparatively open and has only small streams. The western part is exceedingly well favored by large streams. The run-off from this basin reaches the sea chiefly through the Wainiha, Lumahai, Waioli, Hanalei, Kalihiwai, Kilauea, and Moloaa streams.

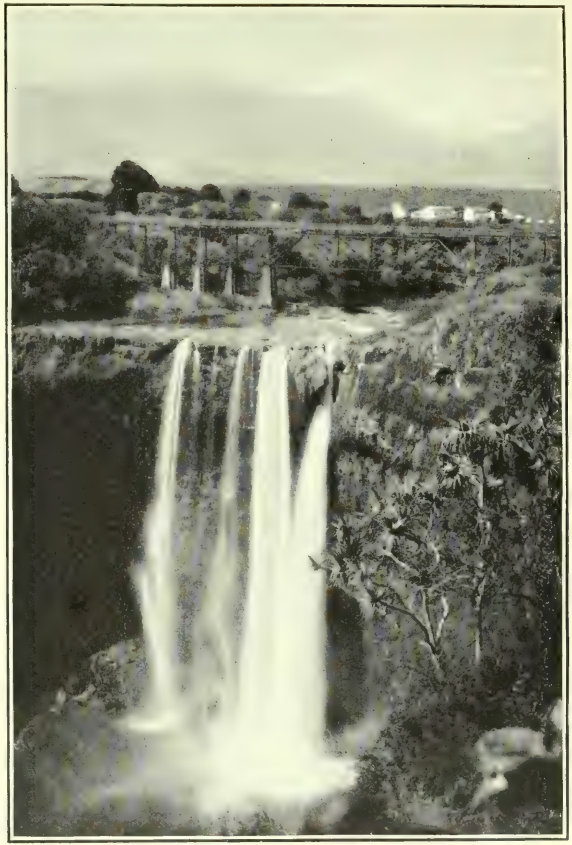
As compared with the other islands, Kauai is unique in several ways. It is the oldest of the larger islands, and consists of one central mountain mass, differing in this respect from Oahu, Maui, and Hawaii, each of which consists of two or more distinct mountain masses formed at different times. Because of its greater age its various natural features are better differentiated.

Erosion has wrought greater changes on Kauai than on the other islands. The valleys are longer, deeper, and broader. Permanent streams flow out to sea in every direction except on the western side, which is deprived of streams largely because of the deep Waimea Canyon. This canyon occupies a position at right angles to the general slope and intercepts the flow toward the west. The streams are not only of good size, but are more uniform in flow and flatter in grade than the streams on the other islands, though there are some waterfalls. (See Pl. VII.) The rainfall varies greatly in different localities according to exposure to trade winds and mountain masses and to elevation above the sea, but the range is not so great and irregular as on the other islands. The average annual rainfall near sea level ranges from 15 or 20 inches at Mana to 63 inches at Koloa, on the leeward side, and from 45 inches at Lihue to 100 inches at Hanalei, on the windward side. The increase is rapid with increase in elevation, so that at 1,000 to 2,000 feet the rainfall ranges from 100 to 200 inches annually on the windward slopes. The fragmentary records available indicate that the increase continues to the summit of Waialeale, where the rainfall probably exceeds 400 inches a year.

Every important stream on Kauai is drawn upon to a greater or less extent for irrigation. The chief demand is for irrigation of cane, and the larger ditches are for that purpose. The cane belt extends from Mana on the west to Kilauea on the north, and all the streams within that area furnish water for cane. Rice is grown on the lowlands and in all the valleys. Some taro is also grown in the valleys. Both rice and taro require large quantities of water and are grown only on the lowlands where water is easily obtained. Pineapples are also grown on Kauai and cotton is being tried, but these crops are not irrigated.

Kauai is called the "garden island," probably on account of its flora, which is said to be more diverse and better developed than the flora on any of the other islands. The line of dense vegetation no longer reaches down to the sea as it probably did originally, but has receded a considerable distance from the shore. At the present time the dense vegetation is largely confined to the higher elevations, and even there it is being opened up somewhat through the depredations of wild pigs and a few wild cattle. Most of the forested area is now included in forest reserves, and efforts are being made to prevent further injury to the existing forests and encourage reforestation. The Territorial Government is much interested in preserving the forests because a large part of Kauai is still in public ownership, and so also is much of the water which is closely related to the forest cover. Private parties are also cooperating in preserving the forest and in reforestation.

A. KAHOALELE FALLS, KAUAI.



B. WAIEHU FALLS, SOUTH FORK OF WAILUA RIVER, KAUAI.

TYPICAL WATERFALLS.

The population of Kauai by the census of 1910 was 23,952. Of these about one-half consists of Japanese, Chinese, and Portuguese. A large number of the Chinese are engaged in the rice industry, which they principally control. The people live in small towns or villages, the largest of which are Waimea and Lihue. Lihue is the county seat and nearest landing from Honolulu. Other places of importance are Kekaha, Makaweli, Hanapepe, Eleele, Koloa, Kealia, Kilauea, and Hanalei. Kauai has no good harbor at the present time, but will have one in the near future. It has excellent roads which extend almost completely around the island and greatly facilitate overland travel.

WAIMEA RIVER BASIN.

GENERAL FEATURES.

Waimea River basin comprises an area of approximately 58 square miles, exclusive of Makaweli River basin. It is much larger than any other river basin on Kauai. It lies north of Makaweli basin, west of Wainiha basin, and south of Kaunuohua Ridge, which separates it from the Napali section. In shape it is almost a perfect square in its upper part, 7 miles on a side, with a handle attached to the south corner. The slope is toward the southwest. All the streams rise on the northeastern side at an elevation of 4,000 to 5,000 feet, and flow in parallel courses southwestward to the main stream, which runs southward in a canyon 2,000 to 3,000 feet deep. The main Waimea is called Poomau River in the upper part of its canyon. Disregarding change of name, the chief tributaries from north to south are Kauaikanana and Kokee streams from the west, and Kawaikoi, Waiakoali, Mohihi, Koaie, Waialae, and Mokihana streams from the east. Of all the tributaries the Koaie has the deepest and longest canyon, which reaches well back toward its source.

The Waimea basin lies on the leeward side of the main divide northwest of the Waialeale rain region, and receives less rain than the basins on the windward side. Ten rain gages were placed in the upper part of this basin in 1910 at elevations of 3,400 to 4,400 feet, and the rainfall for 1911 as shown by them ranged from 80 or 90 inches in the southern and western parts to more than 200 inches in the eastern and northern parts. (See pp. 410–415.) The northern part of the basin consists of an open, swampy country which serves as a natural reservoir for regulating the flow of the streams.

Water is diverted for irrigation at various points below elevation 600 feet. The principal ditches in order downstream are Kekaha, Waimea, and Kamenehune, all of which divert water for use on the west side. Numerous other small rice and taro ditches exist in the valley.

Gaging stations have been established on Kawaikoi, Waiakoali, Mohihi, and Waialae streams in the upper part of the basin and on Waimea River and the three main ditches below.

WAIMEA RIVER NEAR WAIMEA, KAUAI.

A gage was established on Waimea River July 9, 1910, at a point about 1,000 feet above its confluence with Makaweli River, and records were kept until October, 1911. The gage heights were affected at times by high water in Makaweli River and by backwater resulting from the accumulation of sand at the mouth. The channel was also subject to scouring and silting during high stages. No provision was made for obtaining high-water measurements, and only wading measurements could be made.

A new station was established October 5, 1911, just above the ford about 1 mile above the old station and about 2 miles from the town of Waimea. A staff gage on the right bank, graduated in tenths of feet and read daily, is used to obtain gage heights. A wire suspension bridge is used for making measurements except at low water, when wading measurements are made.

The stream bed is 70 feet wide, and the extreme range in stage is probably 8 to 10 feet.

The station is below the main ditches, and the flow at dry periods represents only waste or seepage water, since the ditches at such periods take all the water at the points of diversion.

Discharge measurements of Waimea River near Waimea, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 10	W. F. Martin	27	8.8	1.50	5.7
Sept. 28	Martin, Pierce, Mendes	46	51	1.90	41.1
Oct. 27	J. E. Mendes	100	180	3.60	380
Nov. 15	Martin and Mendes	29	42.3	2.50	12.7
1911.					
Feb. 16	Martin and Hoyt	60	61	2.98	88
Apr. 29	W. F. Martin	50	43.0	2.38	39.3
Sept. 15[a]	W. V. Hardy	7.2	3.8	[b]3.80	2.24
Nov. 4[a]	do	3.5	1.0	[c]3.78	0.91

[a] Measurement made at new station about one-half mile above the old one, which was abandoned because of shifting channel.
[b] Gage height at old station 2.80.
[c] Gage height at old station 1.72.

NOTE.—An additional measurement made early in 1912 was used in determining the rating. Measurements made by wading at various sections.

Daily gage height, in feet, of Waimea River near Waimea, Kauai for 1910–11.

[S. D. Z. Naahielua and T. Mokuahakea, observers.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	.....	1.48	1.45	1.44	1.90	4.18	16	1.58	1.43	1.66	a2.92	2.46	2.35
2	.....	1.45	1.45	a2.01	7.90	4.18	17	a1.84	a1.95	a2.10	1.48	2.44	2.35
3	.....	1.45	1.45	a2.09	5.30	3.22	18	1.55	1.40	a3.21	a2.31	2.42	2.35
4	.....	1.88	1.45	1.43	4.05	2.75	19	1.50	1.40	1.50	1.52	2.40	2.32
5	.....	3.40	1.45	a2.30	4.05	2.65	20	2.12	1.48	2.09	1.42	2.38	2.30
6	.....	1.74	1.45	a2.19	3.48	2.82	21	1.70	3.00	1.70	a2.05	2.38	2.29
7	.....	1.50	1.45	1.50	3.13	3.59	22	1.52	1.68	a1.86	a1.85	2.38	2.28
8	.....	1.49	1.45	a3.12	2.96	2.75	23	1.50	1.48	a3.32	a2.88	2.38	2.28
9	1.50	1.47	1.45	1.92	2.82	2.54	24	1.50	1.45	1.60	a3.80	2.38	3.75
10	1.50	1.48	1.45	1.90	2.68	2.50	25	a1.60	1.68	1.50	1.62	2.38	5.95
11	1.50	1.56	a1.58	1.50	3.20	2.48	26	a2.68	1.92	1.50	1.66	2.59	4.22
12	1.50	1.46	a2.45	1.50	2.83	2.45	27	2.76	1.55	2.13	5.68	2.65	4.14
13	1.70	1.44	a2.64	1.66	2.64	2.44	28	1.78	1.50	1.85	5.75	2.46	2.98
14	1.54	1.43	1.65	1.64	2.52	2.38	29	1.58	1.50	1.62	2.82	2.95	3.30
15	1.50	1.43	3.42	a1.76	2.48	2.35	30	1.51	1.48	1.50	2.31	2.75	6.85
							31	1.50	1.46	.....	2.08	.....	3.82

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	3.28	5.95	3.24	3.18	2.01	2.44	1.82	1.70	a1.80	.....	3.75	3.85
2	2.95	4.18	2.98	3.04	1.94	2.15	1.80	1.70	a2.70	.....	3.80	3.85
3	2.64	3.36	2.88	2.91	1.90	2.04	1.75	1.70	a2.58	.....	3.70	3.81
4	2.52	4.05	2.78	2.70	1.98	2.02	2.12	1.70	1.70	.....	3.65	3.80
5	5.23	3.38	2.73	2.60	2.10	1.99	1.97	1.68	a1.82	4.00	3.80	3.80
6	4.60	5.27	2.70	2.50	2.02	2.00	2.15	1.68	a2.08	.....	3.75	3.80
7	3.75	4.44	2.70	2.41	1.94	2.75	1.99	1.68	1.70	.....	3.80	3.80
8	6.45	5.38	4.18	2.38	1.89	3.28	1.76	1.68	1.70	.....	3.80	5.60
9	4.62	5.79	3.54	2.32	4.58	2.29	1.71	1.76	2.00	3.85	3.80	4.40
10	4.28	6.88	3.00	2.27	2.76	2.10	1.70	1.70	2.29	3.83	3.80	4.40
11	4.26	4.12	2.82	2.23	2.25	1.90	1.70	1.68	2.08	3.82	3.80	5.50
12	4.28	3.55	2.77	2.19	1.98	1.80	1.70	1.68	1.92	3.80	3.80	4.80
13	4.54	3.35	2.71	2.17	1.94	2.12	1.70	1.68	1.70	3.80	3.79	4.81
14	3.61	3.15	2.62	2.16	2.75	2.48	a2.80	1.68	1.70	3.80	4.61	4.09
15	3.36	2.96	2.57	2.13	3.38	1.92	1.70	1.68	1.70	3.81	4.19	7.20
16	3.30	2.87	2.85	2.09	3.40	1.79	1.70	1.68	1.70	3.80	4.05	5.20
17	5.95	2.76	3.28	2.04	2.48	1.76	1.70	1.68	2.65	3.80	5.00	5.02
18	5.45	2.68	3.31	2.00	2.25	1.76	1.75	a1.79	3.88	3.79	5.21	5.00
19	6.12	2.62	3.40	2.00	2.05	1.76	1.75	a2.70	2.28	3.80	6.30	4.50
20	4.50	2.56	3.44	2.30	1.91	1.76	1.70	1.73	1.85	3.80	5.40	4.10
21	3.74	2.51	3.22	2.12	2.48	1.76	1.75	1.70	1.95	3.75	5.38	4.00
22	3.54	2.50	4.55	2.65	2.54	1.76	a1.80	1.70	1.70	3.75	5.32	3.97
23	3.32	2.50	3.43	5.40	2.50	1.76	a2.64	1.70	2.74	3.71	4.90	5.80
24	4.90	4.24	2.86	5.52	2.04	1.78	a2.90	1.70	6.70	3.80	3.81	5.00
25	4.60	3.34	5.50	3.59	1.94	1.84	1.70	a1.80	3.38	4.00	6.22	4.00
26	3.39	5.81	4.89	2.89	1.90	1.80	1.70	a2.55	2.65	3.82	4.90	4.00
27	3.22	4.51	4.24	2.49	4.18	2.32	1.70	1.70	2.70	3.71	5.02	3.90
28	3.50	3.70	3.82	2.62	3.58	2.38	4.34	1.70	2.28	3.71	4.40	3.90
29	3.17	.....	3.73	2.45	5.25	1.88	2.44	1.70	2.12	3.71	3.93	6.01
30	2.95	.....	4.20	2.18	3.06	1.84	1.84	1.70	1.95	3.71	3.90	4.59
31	3.07	.....	3.42	.....	2.65	.....	1.72	1.70	.....	3.71	.....	4.00

a Gage height affected by backwater caused by sand bar at mouth of river.

Daily discharge, in second-feet, of Waimea River near Waimea, Kauai, for 1910–11.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1		6	4	4	41	290	16	12	4	16	a 9	10	4
2		4	4	a 4	2,200	290	17	a 10	a 3	a 13	6	10	4
3		4	4	a 4	660	93	18	9	2	a 9	a 6	7	4
4		41	4	4	250	36	19	6	2	6	6	7	2
5		323	4	a 5	250	26	20	64	6	64	2	7	2
6		25	4	a 6	140	41	21	20	225	20	a 4	7	2
7		6	4	6	86	160	22	6	20	a 17	a 6	7	2
8		6	4	a 24	59	36	23	6	6	a 15	a 8	7	2
9	6	4	4	41	41	16	24	6	4	12	a 10	7	190
10	6	6	4	41	30	13	25	a 61	20	6	12	7	965
11	6	9	a 7	6	93	13	26	a 116	41	6	16	21	290
12	6	4	a 10	6	47	10	27	172	9	70	1,360	26	275
13	20	4	a 13	16	26	10	28	30	6	36	1,390	10	65
14	9	4	16	16	13	7	29	12	6	12	182	59	109
15	6	4	323	a 13	13	4	30	6	6	6	92	36	1,480
							31	6	4	.....	64	.....	200

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	109	1,100	130	145	8	50	2	0	a 0	a 18	1.1	4.6
2	59	355	95	120	4	20	0	0	a 0	a 17	2.2	4.6
3	26	150	80	95	2	12	0	0	a 0	a 16	.0	2.2
4	13	310	65	65	8	8	22	0	0	a 13	.0	2.2
5	640	165	60	55	15	8	10	0	a 0	12	2.2	2.2
6	410	740	55	55	8	8	25	0	a 0	a 11	1.1	2.2
7	190	430	55	45	4	90	15	0	0	a 8	2.2	2.2
8	1,240	810	350	45	2	185	0	0	0	a 6	2.2	187
9	410	1,020	190	35	560	35	0	0	25	4.6	2.2	40
10	320	1,690	95	30	90	15	0	0	55	4.6	2.2	40
11	305	330	65	30	30	2	0	0	30	2.2	2.2	170
12	320	190	60	25	8	0	0	0	15	2.2	2.2	77
13	420	150	65	20	4	15	0	0	0	2.2	2.2	77
14	175	115	55	20	90	55	a 0	0	0	2.2	58	18
15	130	85	50	20	210	2	0	0	0	2.2	25	580
16	120	70	90	15	210	0	0	0	0	2.2	15	125
17	560	60	160	12	55	0	0	0	100	2.2	100	100
18	390	55	160	8	30	0	0	a 0	380	2.2	125	100
19	620	45	180	8	12	0	0	a 0	55	2.2	338	49
20	400	35	190	35	2	0	0	0	10	2.2	154	18
21	210	30	145	15	55	0	0	0	20	1.1	154	12
22	165	30	500	75	65	0	a 0	0	0	1.1	139	10
23	120	30	190	920	55	0	a 0	0	120	.0	88	225
24	540	370	90	970	12	0	a 0	0	1,820	2.2	2.2	100
25	435	150	910	250	4	4	0	a 0	250	12	314	12
26	140	1,010	630	110	2	0	0	a 0	100	2.2	88	12
27	105	450	400	55	420	45	0	0	110	.0	100	7
28	160	225	275	70	250	55	500	0	55	.0	40	7
29	95	.....	265	50	840	6	60	0	30	.0	10	268
30	70	.....	385	25	140	4	4	0	20	.0	7	58
31	105	.....	180	.....	75	.....	0	0	.....	.0	.....	12

a Discharge interpolated, because gage heights were unreliable.

NOTE.—Daily discharge computed from rating curves covering short periods and by the indirect method for shifting channels. Daily discharge after Oct. 1, 1911, obtained from a rating curve at the new station, which was poorly defined. The discharge at this station includes only the water passing out to sea through Waimea River below all diversions.

Monthly discharge of Waimea River near Waimea, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
July 9–31	172	6	26.1	1,190	B.
August	323	2	26.3	1,620	B.
September	323	4	23.9	1,420	C.
October	1,390	2	109	6,700	C.
November	2,200	7	139	8,270	B.
December	1,480	2	150	9,220	B.
1911.					
January	1,240	13	290	17,800	B.
February	1,690	30	364	20,200	B.
March	910	50	201	12,400	B.
April	970	8	114	6,780	B.
May	840	2	105	6,460	B.
June	185	0	20.6	1,230	C.
July	500	0	20.6	1,270	C.
August	0	0	0.0	0	.....
September	1,820	0	106	6,310	C.
October	18	0	4.86	299	C.
November	338	0	59.3	3,530	C.
December	580	2.2	75.0	4,610	D.
The year	1,820	0	111.8	80,900	.....

NOTE.—These estimates include only the water passing to sea below all diversions.

KAWAIKOI STREAM NEAR WAIMEA, KAUAI.

Kawaikoi Stream rises in Alakai Swamp, in the northern part of Waimea basin, and discharges into Poomau River about 3 miles below. It drains 5 or 6 square miles and has a gentle grade except near its mouth, where it drops about 1,300 feet in a short distance.

A gage-height record was started by A. F. Knudsen, in April, 1909, at the ford only a short distance above the falls. In May, 1910, a station was established about 300 feet above the ford at 3,400 feet elevation, and the gage heights at the old gage were transferred to the new gage. A Friez register was installed for obtaining gage heights and a wire bridge was built for use in making high-water measurements. During the latter part of 1911 the Friez instrument was replaced by a Barrett & Lawrence hydro-chronograph in order to reduce the number of necessary visits from one a week to one a month.

The range in stage from low water to extreme high water is about 10 feet at the station.

Discharge measurements of Kawaikoi Stream near Waimea, Kauai, in 1909–1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 10	W. F. Martin	27	69	2.19	49.4
12	do	13.8	14.0	1.53	7.0
1910.					
Jan. 20	do	41.5	70	2.49	84
May 23	Martin and Dodge	31.8	57	1.84	14.0
Nov. 13	Martin and Mendes	70	80	1.74	10.4
14	do	13.8	18.3	1.71	10.0
1911.					
Apr. 22	W. F. Martin	29.5	86	1.93	13.2
23[a]	do	29.0	127	3.10	103
Sept. 8	Hardy and Horner	25.0	99	2.95	81
Oct. 12	W. V. Hardy	7.0	3.75	1.65	6.0

[a] Measurement made from bridge.

NOTE.—Measurements made by wading at various sections except as noted.

Daily gage height, in feet, of Kawaikoi Stream near Waimea, Kauai, for 1909–1911.

[F. B. Dodge, J. E. Mendes, and D. E. Horner, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1					2.42	0.95	1.92	1.98	1.68	1.57	1.85	1.36
2					2.73	1.43	1.85	1.84	1.63	1.50	1.88	1.53
3					2.20	1.43	1.63	1.80	1.56	1.50	1.92	1.59
4					2.19	1.53	1.53	1.66	1.82	1.48	1.80	1.79
5					1.99	1.63	.....	1.63	1.94	1.43	.....	2.70
6					2.01	1.49	2.29	1.59	1.68	1.40	1.60	1.76
7					1.90	1.41	2.25	1.56	1.82	1.37	1.56	1.62
8					1.82	1.40	2.10	1.56	1.66	1.36	1.53	.....
9					1.79	1.39	1.62	1.56	1.94	1.33	1.49	1.41
10					2.10	1.40	2.55	1.53	1.84	1.33	1.48	2.24
11					2.05	1.50	2.10	1.59	1.64	1.31	1.44	1.69
12					1.84	1.52	2.53	1.53	1.55	1.29	1.71	1.55
13				1.75	1.82	1.59	2.06	1.72	1.52	1.63	2.34	1.44
14				1.71	2.04	1.50	2.62	1.95	1.49	1.62	1.75	1.38
15				1.71	1.82	1.95	2.07	1.71	1.63	2.48	1.71	1.38
16				1.68	1.76	1.60	2.75	1.59	2.01	1.76	1.60	1.38
17				1.66	1.75	1.74	2.08	1.53	1.75	1.55	1.52	1.41
18				1.67	1.68	1.55	2.19	1.74	1.57	1.45	1.50	1.63
19				1.68	1.63	2.58	2.33	1.82	1.57	1.52	1.44	2.38
20				1.71	1.76	2.01	2.41	1.79	1.76	1.64	1.44	2.18
21				1.84	1.66	2.05	2.11	1.98	1.59	1.62	1.43	.....
22				1.68	1.60	1.91	1.95	2.39	1.50	1.67	1.41	.....
23				1.64	1.56	1.62	1.80	2.10	1.64	2.47	1.40	.....
24				1.60	1.53	2.49	1.75	2.49	1.71	1.95	1.39	.....
25				1.59	1.52	1.76	1.76	1.92	1.57	3.02	1.39	.....
26				1.66	1.50	1.60	1.91	1.78	1.53	2.22	1.36	.....
27				1.88	1.49	1.52	2.38	1.71	1.50	1.82	1.40	6.50
28				1.75	1.52	2.01	2.10	1.75	1.53	2.01	1.33	.....
29				1.66	1.60	1.69	2.41	1.87	1.75	1.79	1.31	.....
30				3.30	1.50	2.25	2.10	1.87	1.71	1.68	1.36	.....
31				.....	1.46	.....	1.92	1.72	.....	2.44	.....	.....
1910.												
1			1.62	.....	1.82	2.3	1.95	1.6	1.5	1.9	.....	1.75
2				.....	1.78	2.8	1.85	1.6	1.5	1.85	.....	1.75
3		1.94	.....	3.80	.....	2.67	1.75	1.6	1.5	1.9	.....	1.8
4		1.91	2.53	2.08	.....	2.05	2.4	2.1	.....	1.8	2.2	1.8
5		1.90	2.22	.....	.....	2.05	1.95	2.5	.....	1.7	2.0	1.75
6		1.87	1.98	1.85	2.39	1.9	1.8	1.9	.....	1.8	2.1	1.55
7		1.82	1.80	2.20	.....	1.9	1.8	1.6	.....	2.0	2.1	1.5
8	1.87	1.75	1.69	2.02	2.02	2.49	1.75	1.6	.....	2.6	2.1	1.55
9				1.90	2.22	2.9	1.65	1.55	2.2	2.15	2.0	1.5
10	1.82	3.38	.....	.....	.....	2.3	1.65	1.55	1.7	2.0	1.9	1.5

Daily gage height, in feet, of Kawaikoi Stream near Waimea, Kauai, for 1909–1911—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
11	1.92	2.33	.....	1.74	.....	2.66	2.07	1.55	1.5	1.8	1.9	1.5
12	2.10	2.06	.....	1.71	.....	3.0	2.1	1.5	1.5	1.7	1.8	1.5
13	3.28	2.29	.....	1.68	1.82	2.6	1.8	1.5	1.85	1.7	1.8	1.45
14	2.13	2.25	1.79	.....	1.76	2.59	1.92	1.5	1.6	1.7	1.75	1.4
15	1.99	2.18	1.59	.....	1.71	3.2	2.3	1.5	1.7	1.55	1.7	1.4
16	2.26	2.02	1.55	1.62	1.92	2.3	2.1	1.5	2.0	1.5	1.7	1.4
17	3.10	1.92	1.50	2.64	1.80	3.02	1.8	1.5	1.8	1.5	1.7	.....
18	2.97	1.87	1.49	1.94	.....	2.7	1.8	1.5	1.6	1.5	1.65	.....
19	2.25	1.84	1.80	1.88	.....	2.3	1.95	1.5	1.5	1.5	1.6	.....
20	2.62	1.82	.....	.....	2.10	2.55	1.9	2.68	2.05	1.5	1.6	.....
21	3.20	1.87	1.90	.....	1.95	2.82	1.8	2.6	2.2	1.6	1.6	.....
22	.....	1.82	2.06	2.08	1.90	2.4	1.7	1.9	2.61	1.75	1.6	.....
23	.....	1.74	2.67	2.04	1.84	2.1	1.8	1.7	3.2	1.7	1.6	.....
24	.....	.....	2.60	4.61	1.78	2.37	2.1	1.6	1.8	1.7	1.6	.....
25	.....	1.68	2.27	4.08	1.74	2.4	1.95	2.03	2.0	1.6	1.6	.....
26	.....	1.64	1.95	2.41	1.75	2.63	1.75	1.85	2.77	1.55	1.6	.....
27	.....	1.63	.....	.....	1.75	2.2	1.9	1.6	2.7	4.57	1.65	.....
28	.....	1.60	1.99	1.97	1.75	2.0	1.75	1.7	2.2	3.5	1.7	.....
29	.....	.....	2.16	1.90	2.55	2.1	1.7	1.6	1.9	2.2	1.7	.....
30	.....	.....	1.91	1.85	2.95	2.1	1.6	1.55	2.0	.....	1.7	.....
31	.....	.....	.....	.....	2.3	.....	1.6	1.5	.....	.....	.....	.....
1911.												
1	.....	.....	2.0	2.2	1.95	2.3	1.85	1.6	1.8	2.0	1.5	1.85
2	.....	.....	2.0	2.15	1.9	2.2	1.8	1.55	1.6	1.9	1.5	1.75
3	.....	.....	2.0	2.1	1.95	2.0	1.7	1.55	1.6	1.9	1.5	1.7
4	.....	.....	1.8	2.1	2.0	2.0	1.0	1.55	1.55	1.95	1.5	1.75
5	.....	.....	1.85	2.05	2.0	2.05	1.85	1.55	1.7	2.2	1.5	1.65
6	.....	.....	1.8	1.95	2.0	2.0	2.15	1.55	1.6	1.95	1.5	1.65
7	2.4	1.8	1.8	1.9	1.9	2.05	1.9	1.55	1.65	2.0	1.5	1.75
8	2.4	1.85	1.8	1.8	1.95	2.1	1.85	1.55	2.44	1.95	1.5	2.6
9	2.45	1.9	1.85	1.8	1.95	2.25	1.75	1.55	2.8	1.9	1.5	2.1
10	2.45	1.9	1.85	1.8	1.9	2.2	1.8	1.55	2.4	1.8	1.5	2.1
11	2.45	1.9	1.95	1.8	1.9	2.15	2.0	1.5	2.5	1.7	1.5	2.5
12	2.45	1.9	1.95	1.8	1.9	2.05	1.95	1.5	2.1	1.7	1.5	2.25
13	2.45	1.9	1.95	1.8	1.9	2.0	1.9	1.5	1.85	1.65	1.55	2.15
14	2.48	1.9	1.95	1.8	1.95	2.0	1.9	1.55	1.75	1.6	1.75	2.2
15	.....	.....	1.95	1.8	2.0	1.9	1.9	1.6	2.1	1.6	1.9	3.4
16	.....	.....	1.95	1.8	2.0	1.8	1.85	1.8	1.85	1.6	1.75	2.55
17	.....	.....	2.0	1.8	2.0	1.75	2.2	1.65	2.95	1.6	1.75	2.45
18	.....	2.0	3.1	1.8	2.0	1.75	1.8	1.55	2.7	1.6	2.5	2.4
19	.....	2.0	3.15	1.8	2.0	1.8	1.75	1.5	2.0	1.6	3.4	2.15
20	.....	2.0	3.15	1.8	2.0	1.9	2.0	1.7	1.95	1.55	2.4	2.0
21	.....	2.0	3.15	1.8	1.95	2.1	1.95	1.65	2.7	1.55	2.95	1.8
22	.....	1.95	3.2	1.95	1.9	1.9	1.8	1.55	2.5	1.55	2.8	1.75
23	.....	1.95	3.2	2.8	1.9	1.9	2.15	1.55	2.2	1.55	1.9	2.6
24	.....	2.0	3.2	2.95	1.85	1.9	2.0	1.5	4.3	1.5	.....	2.0
25	.....	2.0	4.35	2.75	1.85	2.09	1.75	1.5	2.3	1.5	.....	1.85
26	.....	2.0	3.0	2.5	2.69	2.3	1.65	1.65	2.6	1.5	.....	1.8
27	.....	2.0	2.5	2.15	3.7	2.4	1.8	2.0	2.4	1.5	2.7	1.75
28	.....	.....	2.35	2.15	3.5	1.9	2.6	1.65	2.4	1.5	2.15	2.82
29	.....	.....	2.3	2.15	3.1	1.8	1.9	1.6	2.2	1.5	2.0	2.0
30	.....	.....	2.3	2.1	2.75	2.0	1.7	1.55	1.9	1.5	2.0	1.85
31	.....	.....	2.3	.....	2.40	.....	1.65	1.9	.....	1.5	.....	1.95

Daily discharge, in second-feet, of Kawaikoi Stream near Waimea, Kauai for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	.....	.....	.....	.....	54	0.0	18	21	8.0	5.4	14	2.1
2	.....	.....	.....	.....	88	3.0	14	14	6.8	4.0	16	4.6
3	.....	.....	.....	.....	35	3.0	6.8	12	5.2	4.0	18	5.8
4	.....	.....	.....	.....	34	4.6	4.6	7.5	13	3.7	12	12
5	.....	.....	.....	.....	22	6.8	a 23	6.8	19	3.0	a 9.0	84
6	.....	.....	.....	.....	23	3.8	42	5.8	8.0	2.5	6.0	11
7	.....	.....	.....	.....	17	2.6	39	5.2	13	2.2	5.2	6.5
8	.....	.....	.....	.....	13	2.5	28	5.2	7.5	2.1	4.6	a 4.6
9	.....	.....	.....	.....	12	2.4	6.5	5.2	19	1.8	3.8	2.6
10	.....	.....	.....	.....	28	2.5	68	4.6	14	1.8	3.7	38
11	.....	.....	.....	.....	25	4.0	28	5.8	7.0	1.6	3.1	8.2
12	.....	.....	.....	.....	14	4.4	65	4.6	5.0	1.4	8.8	5.0
13	.....	.....	.....	10	13	5.8	26	9.2	4.4	6.8	47	3.1
14	.....	.....	.....	8.8	24	4.0	75	20	3.8	6.5	10	2.3
15	.....	.....	.....	8.8	13	20	26	8.8	6.8	60	8.8	2.3
16	.....	.....	.....	8.0	11	6.0	90	5.8	23	11	6.0	2.3
17	.....	.....	.....	7.5	10	10	27	4.6	10	5.0	4.4	2.6
18	.....	.....	.....	7.8	8.0	5.0	34	9.9	5.4	3.2	4.0	6.8
19	.....	.....	.....	8.0	6.8	71	46	13	5.4	4.4	3.1	50
20	.....	.....	.....	8.8	11	23	53	12	11	7.0	3.1	34
21	.....	.....	.....	14	7.5	25	29	21	5.8	6.5	3.0	b 7.0
22	.....	.....	.....	8.0	6.0	18	20	51	4.0	7.8	2.6	b 7.0
23	.....	.....	.....	7.0	5.4	6.5	12	28	7.0	59	2.5	b 7.0
24	.....	.....	.....	6.0	4.6	61	10	61	8.8	20	2.4	b 200
25	.....	.....	.....	5.8	4.4	11	11	18	5.4	123	2.4	b 200
26	.....	.....	.....	7.5	4.0	6.0	18	11	4.6	37	2.1	b 200
27	.....	.....	.....	16	3.8	4.4	50	8.8	4.0	13	2.5	c 1,280
28	.....	.....	.....	10	4.4	23	28	10	4.6	23	1.8	b 100
29	.....	.....	.....	7.5	6.0	8.2	53	16	10	12	1.6	b 100
30	.....	.....	.....	161	4.0	39	28	7.8	8.8	8.0	2.1	b 200
31	.....	.....	.....	.....	3.4	.....	18	9.2	.....	56	.....	b 200
1910.												
1	.....	b 19	6.5	b 45	13	43	20	6.0	4.0	17	b 545	10
2	.....	b 19	a 26	b 45	11	96	14	6.0	4.0	14	b 280	10
3	.....	19	a 46	243	a 21	81	10	6.0	4.0	17	b 120	12
4	.....	18	65	27	a 31	25	52	28	a 9.0	12	35	12
5	.....	17	37	a 20	a 41	25	20	62	a 14	8.5	22	10
6	.....	16	21	14	51	17	12	17	a 19	12	28	5.0
7	.....	13	12	35	a 37	17	12	6.0	a 24	22	28	4.0
8	16	10	8.0	23	23	61	10	6.0	a 29	73	28	5.0
9	a 14	a 90	a 8.7	17	37	108	7.2	5.0	35	32	22	4.0
10	13	173	a 9.4	a 14	a 31	43	7.2	5.0	8.5	22	17	4.0
11	18	44	a 10	10	a 25	80	26	5.0	4.0	12	17	4.0
12	28	26	a 11	8.8	a 19	120	28	4.0	4.0	8.5	12	4.0
13	158	42	a 12	8.0	13	73	12	4.0	14	8.5	12	3.2
14	30	39	12	a 7.5	11	72	18	4.0	6.0	8.5	10	2.5
15	22	34	5.8	a 7.0	8.8	147	43	4.0	8.5	5.0	8.5	2.5
16	40	23	5.0	6.5	18	43	28	4.0	22	4.0	8.5	2.5
17	133	18	4.0	77	12	122	12	4.0	12	4.0	8.5	.....
18	116	16	3.8	19	a 17	84	12	4.0	6.0	4.0	7.2	.....
19	39	14	12	16	a 22	43	20	4.0	4.0	4.0	6.0	.....
20	75	13	a 14	a 20	28	68	17	82	25	4.0	6.0	.....
21	147	16	17	a 24	20	98	12	73	35	6.0	6.0	.....
22	b 25	13	26	27	17	52	8.5	17	74	10	6.0	.....
23	b 25	9.9	81	24	14	28	12	8.5	147	8.5	6.0	.....
24	b 25	a 9.0	73	430	11	49	28	6.0	12	8.5	6.0	.....
25	b 25	8.0	41	298	9.9	52	20	24	22	6.0	6.0	.....
26	b 25	7.0	20	53	10	76	10	14	92	5.0	6.0	.....
27	b 25	6.8	a 21	a 36	10	35	17	6.0	84	418	7.2	.....
28	b 25	6.0	22	20	10	22	10	8.5	35	192	8.5	.....
29	b 25	.....	32	17	67	28	8.5	6.0	17	35	8.5	.....
30	b 25	.....	18	14	114	28	6.0	5.0	22	b 62	8.5	.....
31	b 25	.....	b 18	.....	43	.....	6.0	4.0	.....	b 96	.....	.....

a Discharge interpolated.
b Discharge estimated.
c Discharge estimated with high-water mark as guide.

Daily discharge, in second-feet, of Kawaikoi Stream near Waimea, Kauai for 1909–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	.....	a 12	22	35	20	43	14	6.0	12	22	4.0	14
2	.....	a 12	22	32	17	35	12	5.0	6.0	17	4.0	10
3	.....	a 12	22	28	20	22	8.5	5.0	6.0	17	4.0	8.5
4	.....	a 12	12	28	22	22	1.5	5.0	5.0	20	4.0	10
5	.....	a 12	14	25	22	25	14	5.0	8.5	35	4.0	7.2
6	.....	a 12	12	20	22	22	32	5.0	6.0	20	4.0	7.2
7	52	12	12	17	17	25	17	5.0	7.2	22	4.0	10
8	52	14	12	12	20	28	14	5.0	56	20	4.0	73
9	57	17	14	12	20	39	10	5.0	96	17	4.0	28
10	57	17	14	12	17	35	12	5.0	52	12	4.0	28
11	57	17	20	12	17	32	22	4.0	62	8.5	4.0	62
12	57	17	20	12	17	25	20	4.0	28	8.5	4.0	39
13	57	17	20	12	17	22	17	4.0	14	7.2	5.0	32
14	60	17	20	12	20	22	17	5.0	10	6.0	10	35
15	.....	b 18	20	12	22	17	17	6.0	28	6.0	17	176
16	.....	b 19	20	12	22	12	14	12	14	6.0	10	68
17	.....	b 21	22	12	22	10	35	7.2	114	6.0	10	57
18	.....	22	133	12	22	10	12	5.0	84	6.0	62	52
19	.....	22	140	12	22	12	10	4.0	22	6.0	176	32
20	.....	22	140	12	22	17	22	8.5	20	5.0	52	22
21	.....	22	140	12	20	28	20	7.2	84	5.0	114	12
22	.....	20	147	20	17	17	12	5.0	62	5.0	96	10
23	.....	20	147	96	17	17	32	5.0	35	5.0	17	73
24	.....	22	147	114	14	17	22	4.0	350	4.0	b 34	22
25	.....	22	365	90	14	27	10	4.0	43	4.0	b 51	14
26	.....	22	120	62	83	43	7.2	7.2	73	4.0	b 68	12
27	.....	22	62	32	225	52	12	22	52	4.0	84	10
28	.....	b 22	48	32	192	17	73	7.2	52	4.0	32	99
29	.....	.....	43	32	133	12	17	6.0	35	4.0	22	22
30	.....	.....	43	28	90	22	8.5	5.0	17	4.0	22	14
31	.....	.....	43	.....	52	.....	7.2	17	.....	4.0	.....	20

a Discharge estimated. b Discharge interpolated.

NOTE.—No record Jan. 1 to 7 and Dec. 17 to 31, 1910; also Jan. 1 to 6 and 15 to 31, 1911.

Monthly discharge of Kawaikoi Stream near Waimea, Kauai for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1909.					
April 13–30	161	5.8	17.2	614	B.
May	88	3.4	16.6	1,020	B.
June	71	0.0	12.9	768	B.
July	90	4.6	32.2	1,980	C.
August	61	4.6	13.6	836	B.
September	23	3.8	8.61	512	B.
October	23	1.4	16.2	996	B.
November	47	1.6	7.12	424	B.
December	1,280	2.1	90.0	5,530	D.
The period	.....	.....	.....	12,700	
1910.					
January 8–31	158	13	45.8	2,180	
February	173	6.0	26.4	1,470	C.
March	81	3.8	22.5	1,380	C.
April	430	6.5	53.5	3,180	C.
May	114	8.8	25.7	1,580	C.
June	147	17	61.2	3,640	B.
July	52	6.0	16.7	1,030	B.
August	82	4.0	14.1	867	B.
September	147	4.0	26.5	1,580	C.
October	418	4.0	36.7	2,260	C.
November	a 545	6.0	43.0	2,560	C.
December 1–16	12	2.5	5.92	188	C.
The period b	a 545	2.5	32.2	21,900	

a Estimated. b For 343 days.

Monthly discharge of Kawaikoi Stream near Waimea, Kauai, for 1909–1911—Contd.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1911.					
January 7–14	60	52	56.1	890	
February	22	12	17.7	983	D.
March	365	12	65.0	4,000	B.
April	114	12	28.6	1,700	B.
May	225	14	40.5	2,490	B.
June	52	10	24.2	1,440	B.
July	73	1.5	17.5	1,080	B.
August	22	4.0	6.46	397	B.
September	350	5.0	48.5	2,890	B.
October	35	4.0	10.1	621	B.
November	176	4.0	31.0	1,840	B.
December	176	7.2	34.8	2,140	B.
The period[a]	365	1.5	28.9	20,500	

[a] For 342 days.

WAIAKOALI STREAM NEAR WAIMEA, KAUAI.

Waiakoali Stream drains an area comprising 2 or 3 square miles just south of the Kawaikoi and joins the latter in the gorge below the falls.

A gage was installed in April, 1909, under the direction of A. F. Knudsen, and readings were made in connection with the record on Kawaikoi Stream. In May, 1910, the old gage was replaced by a new one at the ford a few hundred feet above, and the readings on the old gage were transferred to the new. A wooden bridge was also built for use in making highwater measurements. Since the summer of 1910 only occasional gage readings have been made. This station is near the permanent camp house which has been built in the upper Waimea basin.

Discharge measurements of Waiakoali Stream near Waimea, Kauai, in 1909–1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 10	W. F. Martin	3.2	1.18	1.78	1.44
1910.					
Nov. 13	Martin and Mendes	10.1	11.4	2.20	4.10
1911.					
Apr. 22	W. F. Martin	12.5	15.2	2.44	6.4
23	do	18.0	88	3.15	31.2
Sept. 8[a]	Hardy and Horner	2.0	0.86	2.23	1.18
Oct. 13[a]	W. V. Hardy	1.7	0.53	2.24	0.71

[a] Gage height probably affected by growth of grass and weeds in channel below gage.

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Waiakoali Stream near Waimea, Kauai, for 1909–1911.

[F. B. Dodge, J. E. Mendes, and D. E. Horner, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1					2.35	1.6	1.75	1.85	1.65	1.7	1.95	1.5
2					2.8	1.55	1.7	1.75	1.7	1.6	1.85	1.65
3					2.2	1.55	1.6	1.8	1.6	1.55	1.95	1.8
4					2.1	1.55	1.55	1.65	1.65	1.55	1.8	1.95
5					2.0	1.55		1.6	1.65	1.55		3.1
6					1.9	1.55	1.9	1.55	1.65	1.5	1.65	2.0
7					1.9	1.55	2.15	1.55	1.6	1.5	1.6	1.9
8					1.85	1.55	1.85	1.55	1.6	1.5	1.6	
9					1.8	1.5	2.15	1.55	1.75	1.5	1.55	1.7
10					1.9	1.55	1.95	1.5	1.85	1.5	1.55	1.75
11					2.0	1.55	1.9	1.5	1.7	1.5	1.55	1.9
12					1.85	1.55	2.4	1.5	1.6	1.5	1.6	1.75
13				1.95	1.9	1.55	2.0	1.55	1.55	1.5	2.25	1.7
14				1.9	1.7	1.55	1.9	1.75	1.55	1.55	1.8	1.65
15				1.9	1.8	1.55	2.0	1.7	1.6	2.3	1.7	1.6
16				1.9	1.75	1.55	1.9	1.6	2.05	1.6	1.65	1.6
17				1.85	1.75	1.55	1.95	1.55	1.75	1.6	1.6	1.65
18				1.85	1.8	1.55	1.95	1.55	1.7	1.5	1.55	1.65
19				1.9	1.7	1.6	2.1	1.6	1.7	1.5	1.55	2.85
20				2.0	1.75	1.85	2.25	1.6	1.6	1.6	1.55	2.3
21				2.0	1.6	1.7	2.05	1.75	1.65	2.15	1.5	
22				1.9	1.7	1.8	1.8	2.25	1.6	1.7	1.5	
23				1.85	1.65	1.6	1.7	2.1	1.6	1.7	1.5	
24				1.8	1.65	1.6	1.65	2.3	1.6	1.95	1.55	
25				1.8	1.65	1.85	1.65	1.9	1.6	2.8	1.55	
26				1.9	1.65	1.6	1.8	1.7	1.55	1.5	1.5	
27				2.15	1.65	1.55	2.15	1.65	1.55	1.9	1.55	5.0
28				1.9	1.65	1.55	1.9	1.6	1.55	2.2	1.5	
29				1.8	1.6	1.7	1.75	1.65	1.7	1.9	1.45	
30				2.4	1.6	1.65	1.9	1.65	1.75	1.8	1.5	
31					1.6		1.75	1.65		1.9		
1910.												
1			1.95		2.3					2.0		
2					2.15				1.95	2.0		
3		2.2		3.2								
4		2.2	2.75	1.55		2.2						2.25
5		2.15										
6		2.1	2.15	2.15							2.3	
7		2.05	2.05	2.2								
8	2.05	2.05	2.0	2.2	2.3					2.3		
9				2.15					2.65	2.2		1.95
10	2.0	2.4										
11	2.05	2.4		2.0		2.2			2.6			
12	2.05	2.45		1.65								
13	2.15	2.6		1.95	2.15	2.6			2.85		2.2	
14	2.4	2.55	1.9		2.1			1.85			2.2	
15	2.2	2.45	1.9		2.1		2.0	1.95	2.6	2.0		
16	2.45	2.35	1.85	1.95	2.15							
17	3.3	2.2	1.85	2.85	2.15	2.25	2.05	1.95	2.7	1.95		
18	3.25	2.15	1.85	2.2		2.7	2.05	1.95			2.15	
19	2.6	2.1	1.85	2.1				1.95			2.1	
20	2.7	2.1			1.55			2.0				
21	3.2	2.05	1.85		2.35					1.95		
22		2.05	1.95	2.1	2.3				2.45	1.95		
23		2.0	2.65	2.3	2.2			2.5	2.4			
24			2.6	3.7	2.15				2.1		2.1	
25		2.0	2.3	4.9	2.15	2.35						
26		1.95	2.1	2.75	2.15							
27		1.95			2.1			2.05				
28		1.95	2.1	2.3	2.1	2.1						
29			2.2	2.2		2.1				2.4		
30			2.05	2.15								
31												

Daily gage height, in feet, of Waiakoali Stream near Waimea, Kauai, for 1909–1911—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1				2.7			2.4		2.2			
2						2.55	2.4		2.25			
3			2.5			2.5						
4								2.25				
5					2.45			2.3				
6	2.8				2.45							
7				2.5			2.4					
8							2.4		2.25			
9						2.55			2.4			
10			2.5			2.0						
11								2.25				
12					2.5			2.25		2.25		
13	2.85				2.5					2.25		
14				2.45			2.3			2.2		
15							2.4		2.25			
16						2.4			2.3			
17						2.4						
18		2.6	2.6					2.2				
19					2.5			2.2				
20					2.5							
21				2.4			2.35					
22				2.45			2.35		2.5			
23				3.2		2.4			2.5			
24						2.4						
25		2.3	2.7					2.2				
26					2.55			2.2				
27					3.4							
28				2.6			2.7					
29				2.55			2.5		2.45			
30	2.4								2.4			

Daily discharge, in second-feet, of Waiakoali Stream near Waimea, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1					5.4	0.8	1.3	1.8	1.0	1.1	2.2	0.5
2					16	.6	1.1	1.3	1.1	.8	1.8	1.0
3					4.0	.6	.8	1.5	.8	.6	2.2	1.5
4					3.2	.6	.6	1.0	1.0	.6	1.5	2.2
5					2.5	.6	[a] 1.3	.8	1.0	.6	[a] 1.2	29
6					2.0	.6	2.0	.6	1.0	.5	1.0	2.5
7					2.0	.6	3.6	.6	.8	.5	.8	2.0
8					1.8	.6	1.8	.6	.8	.5	.8	[a] 1.6
9					1.5	.5	3.6	.6	1.3	.5	.6	1.1
10					2.0	.6	2.2	.5	1.8	.5	.6	1.3
11					2.5	.6	2.0	.5	1.1	.5	.6	2.0
12					1.8	.6	6.0	.5	.8	.5	.8	1.3
13				2.2	2.0	.6	2.5	.6	.6	.5	4.4	1.1
14				2.0	1.1	.6	2.0	1.3	.6	.6	1.5	1.0
15				2.0	1.5	.6	2.5	1.1	.8	4.9	1.1	.8
16				2.0	1.3	.6	2.0	.8	2.8	.8	1.0	.8
17				1.8	1.3	.6	2.2	.6	1.3	.8	.8	1.0
18				1.8	1.5	.6	2.2	.6	1.1	.5	.6	1.0
19				2.0	1.1	.8	3.2	.8	1.1	.5	.6	18
20				2.5	1.3	1.8	4.4	.8	.8	.8	.6	4.9
21				2.5	0.8	1.1	2.8	1.3	1.0	3.6	.5	[b] 2.0
22				2.0	1.1	1.5	1.5	4.4	.8	1.1	.5	[b] 2.0
23				1.8	1.0	.8	1.1	3.2	.8	1.1	.5	[b] 2.0
24				1.5	1.0	.8	1.0	4.9	.8	2.2	.6	[b] 50
25				1.5	1.0	1.8	1.0	2.0	.8	16	.6	[b] 50
26				2.0	1.0	.8	1.5	1.1	.6	.5	.5	[b] 50
27				3.6	1.0	.6	3.6	1.0	.6	2.0	.6	[c] 260
28				2.0	1.0	.6	2.0	.8	.6	4.0	.5	[b] 25
29				1.5	.8	1.1	1.3	1.0	1.1	2.0	.4	[b] 25
30				6.0	.8	1.0	2.0	1.0	1.3	1.5	.5	[b] 50
31					.8		1.3	1.0		2.0		[b] 50

[a] Discharge interpolated.
[b] Discharge estimated.
[c] Discharge estimated with high-water mark as guide.

Daily discharge, in second-feet, of Waiakoali Stream near Waimea, Kauai, for 1909–1911— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	.....	a 4.0	2.2	a 18	4.9	.....	.....	.....	.....	2.5	.....	.....
2	.....	a 4.0	a 6.2	a 2.7	3.6	.....	.....	.....	2.2	2.5	.....	.....
3	.....	4.0	a 10	34	a 3.8	.....	.....	.....	.....	.....	.....	.....
4	.....	4.0	14	.6	a 4.0	4.0	.....	.....	.....	.....	.....	4.4
5	.....	3.6	a 8.8	a 2.4	a 4.2	.....	.....	.....	.....	.....	.....	.....
6	.....	3.2	3.6	3.6	a 4.4	.....	.....	.....	.....	.....	4.9	.....
7	.....	2.8	2.8	4.0	a 4.8	.....	.....	.....	.....	.....	.....	.....
8	2.8	2.8	2.5	4.0	4.9	.....	.....	.....	.....	4.9	.....	.....
9	a 2.6	a 4.4	a 2.5	3.6	a 4.7	.....	.....	.....	12	4.0	.....	2.2
10	2.5	6.0	a 2.5	a 3.0	a 4.4	.....	.....	.....	.....	.....	.....	.....
11	2.8	6.0	a 2.2	2.5	a 4.1	4.0	.....	.....	10	.....	.....	.....
12	2.8	6.8	a 2.0	1.0	a 3.8	.....	.....	.....	.....	.....	.....	.....
13	3.6	10	a 2.0	2.2	3.6	10	.....	.....	18	.....	4.0	.....
14	6.0	8.8	2.0	a 2.2	3.2	.....	.....	1.8	.....	.....	4.0	.....
15	4.0	6.8	2.0	a 2.2	3.2	.....	2.5	2.2	10	2.5	.....	.....
16	6.8	5.4	1.8	2.2	3.6	.....	.....	.....	.....	.....	.....	.....
17	40	4.0	1.8	18	3.6	4.4	2.8	2.2	13	2.2	.....	.....
18	37	3.6	1.8	4.0	a 2.6	13	2.8	2.2	.....	.....	3.6	.....
19	10	3.2	1.8	3.2	a 1.6	.....	.....	2.2	.....	.....	3.2	.....
20	13	2.2	a 1.8	a 3.2	.6	.....	.....	2.5	.....	.....	.....	.....
21	34	2.8	1.8	a 3.2	5.4	.....	.....	.....	.....	2.2	.....	.....
22	b 6	2.8	2.2	3.2	4.9	.....	.....	.....	6.8	2.2	.....	.....
23	b 6	2.5	12	4.9	4.0	.....	.....	7.7	6.0	.....	.....	.....
24	b 6	a 2.5	10	75	3.6	.....	.....	.....	3.2	.....	3.2	.....
25	b 6	2.5	4.9	243	3.6	5.4	.....	.....	.....	.....	.....	.....
26	b 6	2.2	3.2	14	3.6	.....	.....	.....	.....	.....	.....	.....
27	b 6	2.2	a 3.2	a 9.4	3.2	.....	.....	2.8	.....	.....	.....	.....
28	b 6	2.2	3.2	4.9	3.2	3.2	.....	.....	.....	.....	.....	.....
29	b 6	.....	4.0	4.0	a 3.3	3.2	.....	.....	.....	6.0	.....	.....
30	b 6	.....	2.8	3.6	a 3.4	.....	.....	.....	.....	.....	.....	.....
31	b 6	.....	a 10	.....	a 3.5	.....	.....	.....	.....	.....	.....	.....
1911.												
1	.....	.....	.....	13	.....	.....	3.8	.....	1.0	.....	.....	.....
2	.....	.....	.....	.....	.....	6.2	3.5	.....	1.2	.....	.....	.....
3	.....	.....	7.7	.....	.....	5.5	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	.....	.....	.....	1.8	.....	.....	.....	.....
5	.....	.....	.....	.....	6.5	.....	.....	2.2	.....	.....	.....	.....
6	16	.....	.....	.....	6.5	.....	.....	.....	.....	.....	.....	.....
7	.....	.....	.....	7.7	.....	.....	3.5	.....	.....	.....	.....	.....
8	.....	.....	.....	.....	.....	.....	3.5	.....	1.2	.....	.....	.....
9	.....	.....	.....	.....	.....	6.2	.....	.....	1.9	.....	.....	.....
10	.....	.....	7.7	.....	.....	1.8	.....	.....	.....	.....	.....	.....
11	.....	.....	.....	.....	.....	.....	.....	1.7	.....	.....	.....	.....
12	.....	.....	.....	.....	7.3	.....	.....	1.7	.....	0.8	.....	.....
13	18	.....	.....	.....	6.7	.....	.....	.....	.....	.8	.....	.....
14	.....	.....	.....	6.8	.....	.....	2.5	.....	.....	.6	.....	.....
15	.....	.....	.....	.....	.....	.....	3.2	.....	1.2	.....	.....	.....
16	.....	.....	.....	.....	.....	4.2	.....	.....	1.5	.....	.....	.....
17	.....	.....	.....	.....	.....	4.2	.....	.....	.....	.....	.....	.....
18	.....	10	10	.....	.....	.....	.....	1.4	.....	.....	.....	.....
19	.....	.....	.....	.....	6.7	.....	.....	1.4	.....	.....	.....	.....
20	.....	.....	.....	.....	6.7	.....	.....	.....	.....	.....	.....	.....
21	.....	.....	.....	6.0	.....	.....	2.8	.....	.....	.....	.....	.....
22	.....	.....	.....	6.8	.....	.....	2.6	.....	2.3	.....	.....	.....
23	.....	.....	.....	34	.....	3.8	.....	.....	2.3	.....	.....	.....
24	.....	.....	.....	.....	.....	3.8	.....	.....	.....	.....	.....	.....
25	.....	4.9	13	.....	.....	.....	.....	1.2	.....	.....	.....	.....
26	.....	.....	.....	.....	7.0	.....	.....	1.2	.....	.....	.....	.....
27	.....	.....	.....	.....	18	.....	.....	.....	.....	.....	.....	.....
28	.....	.....	.....	10	.....	.....	5.6	.....	.....	.....	.....	.....
29	.....	.....	.....	8.8	.....	.....	3.6	.....	1.8	.....	.....	.....
30	6.0	.....	.....	.....	.....	.....	.....	.....	1.6	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

a Discharge interpolated. b Discharge estimated.

NOTE.—Daily discharge computed from a rating curve fairly well defined below 40 second-feet. No record for the days on which discharge is omitted.

Monthly discharge of Waiakoali Stream near Waimea, Kauai for 1909–10.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1909.					
April 13–30	6.0	1.5	2.26	80.7	B.
May	16	.8	2.13	131	B.
June	1.8	.5	.79	47.	B.
July	6.0	.6	2.14	132	B.
August	4.9	.5	1.25	76.9	B.
September	2.8	.6	1.00	59.5	B.
October	16	.5	1.70	105	B.
November	4.4	.4	1.00	59.5	B.
December	a260	.5	20.6	1,270	
The period				1,960	
1910.					
January 8–31	40	2.5	9.50	452	C.
February	10	2.2	4.15	230	B.
March	14	1.8	4.25	261	C.
April	243	.6	16.9	1,010	C.
May	5.4	.6	3.72	229	D.

a Estimated.

NOTE.—After May, 1910, the data were insufficient for an estimate.

MOHIHI STREAM NEAR WAIMEA, KAUAI.

Mohihi Stream drains about 3 square miles just south of Waiakoali basin and north of Koaie basin. It is tributary to Poomau River about half a mile below the junction of Kawaikoi and Kauaikanana streams. The lower part of its course lies in a deep canyon, which extends back nearly a mile from its mouth.

A gage was placed at the lower crossing just above the falls in April, 1909, by A. F. Knudsen, and was read daily during the rest of the year. In the summer of 1910 a wire bridge was built for use in making high-water measurements. This station is southeast of the camp, and only occasional gage-height observations have been made since the summer of 1910. The elevation of the station is about 3,400 feet.

Discharge measurements of Mohihi Stream near Waimea, Kauai, in 1909–1911.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 10	W. F. Martin	2.85	3.81	3.70	3.19
Do	do	2.85	3.81	3.70	2.76
1910.					
May 22	Martin and Dodge	7.3	4.78	3.83	5.1
Nov. 13	Martin and Mendes	29.0	60	3.81	3.75
Do	do	7.2	4.30	3.81	3.74
1911.					
Apr. 22	W. F. Martin	20.3	11.6	4.04	9.2
Sept. 8	Hardy and Horner	6.8	2.27	3.68	1.55
Oct. 13	W. V. Hardy	3.7	1.52	3.70	1.69

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Mohihi Stream near Waimea, Kauai, for 1909–1911.

[F. B. Dodge, J. E. Mendes, and D. E. Horner, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1					4.44	3.75	3.90	3.88	3.79	3.79	3.96	3.60
2					4.69	3.75	3.85	3.85	3.83	3.77	3.85	3.71
3					4.17	3.75	3.88	3.85	3.75	3.71	3.92	3.75
4					4.04	3.75	3.83	3.81	3.85	3.71	3.85	3.93
5					3.98	3.75		3.77	3.85	3.71		4.67
6					3.94	3.69	3.96	3.75	3.83	3.66	3.75	3.90
7					3.90	3.69	4.17	3.73	3.73	3.66	3.69	3.79
8					3.90	3.69	3.92	3.73	3.73	3.66	3.69	
9					3.88	3.69	4.27	3.73	3.83	3.64	3.67	3.69
10					3.96	3.69	3.94	3.71	3.88	3.64	3.67	3.71
11					4.08	3.69	3.96	3.71	3.79	3.62	3.65	3.62
12					3.94	3.71	4.25	3.71	3.75	3.62	3.71	3.75
13				3.85	3.90	3.71	4.02	3.73	3.73	3.62	4.15	3.69
14				3.85	3.88	3.71	3.96	3.94	3.66	3.64	3.83	3.67
15				3.83	3.88	3.71	4.08	3.85	3.75	3.69	3.75	3.65
16				3.83	3.88	3.71	3.94	3.88	4.04	3.85	3.73	3.65
17				3.83	3.88	3.71	3.98	3.75	3.85	3.73	3.69	3.65
18				3.85	3.85	3.73	4.00	3.79	3.79	3.69	3.67	3.65
19				3.88	3.83	3.77	4.14	3.79	3.71	3.67	3.65	4.35
20				3.92	3.81	4.02	4.19	3.81	3.75	3.75	3.65	4.04
21				4.02	3.81	3.90	4.10	3.85	3.73	4.02	3.62	
22				3.90	3.79	3.96	3.88	4.33	3.73	3.79	3.62	
23				3.88	3.79	3.83	3.83	4.19	3.71	3.83	3.67	
24				3.88	3.77	3.79	3.79	4.27	3.73	3.98	3.60	
25				3.85	3.77	3.88	3.79	3.98	3.73	4.08	3.54	
26				3.85	3.77	3.79	3.92	3.83	3.69	4.21	3.58	
27				4.17	3.77	3.75	4.42	3.75	3.69	3.94	3.58	7.90
28				3.96	3.77	3.75	4.08	3.75	3.71	4.29	3.60	
29				3.90	3.79	3.83	4.29	3.79	3.79	3.94	3.60	
30				4.38	3.77	3.79	4.00	3.79	3.88	3.83	3.60	
31					3.77		3.88	3.81		3.90		
1910.												
1			3.79		3.88							
2					3.85						5.00	
3		4.00		4.66								
4		3.98	4.50									
5		3.96										3.85
6		3.94	4.04	3.90								
7		3.92	3.96	3.96			3.80					
8	3.94	3.88	3.85	3.94	3.98							
9				3.92				3.72				
10	3.88	4.38										
11	3.92	4.17		3.81								
12	4.11	4.12		3.79								
13	5.12	4.25		3.79	3.85			3.68			3.81	
14	4.25	4.17	3.79		3.81							
15	4.08	4.15	3.75		3.79			3.65				
16	4.27	4.10	3.75	3.75	3.85					3.70		
17	4.71	3.94	3.75	4.31	3.83							
18	4.96	3.92	3.75	4.02								
19	4.38	3.88	3.73	3.94							3.75	
20	4.52	3.85										
21	5.00	3.85	3.75				3.75			3.74		
22		3.85	3.79	3.90	3.85							
23		3.83	4.44	4.02								
24			4.40		3.79			3.73				
25		3.83	4.08								3.72	
26		3.81	3.92	4.35				3.92				
27		3.79				3.92						
28		3.79	3.96	3.96	3.75							
29			4.10									
30			3.90	3.88						3.92		
31												

Daily gage height, in feet, of Mohihi Stream near Waimea, Kauai, for 1909–1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1				4.60			3.84		3.68			
2							3.86					
3						4.40						
4			4.20					3.70				
5					3.90							
6	4.05											
7				3.98			3.82					
8									3.68			
9						4.02						
10			4.80									
11								3.70				
12					3.94							
13	4.10									3.70		
14				3.92			3.72					
15									3.71			
16						3.90						
17		4.12	4.40									
18								3.68				
19					4.00							
20												
21							3.79					
22				4.04					3.96			
23						3.88			4.10			
24												
25		4.12	4.44					3.68				
26					4.30							
27					4.78							
28				4.10			4.20					
29									3.84			
30												
31	3.86											

Daily discharge, in second-feet, of Mohihi Stream near Waimea, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1					26	3.0	5.8	5.8	3.8	3.8	7.0	1.0
2					42	3.0	4.8	4.8	4.8	3.0	4.8	2.3
3					12	3.0	5.8	4.8	3.0	2.3	5.8	3.0
4					9.6	3.0	4.8	3.8	4.8	2.3	4.8	7.0
5					8.2	3.0	[a] 5.9	3.0	4.8	2.3	[a] 3.9	38
6					7.0	2.3	7.0	3.0	4.8	1.6	3.0	5.8
7					5.8	2.3	12	3.0	3.0	1.6	2.3	3.8
8					5.8	2.3	5.8	3.0	3.0	1.6	2.3	[a] 3.0
9					5.8	2.3	16	3.0	4.8	1.6	1.6	2.3
10					7.0	2.3	7.0	2.3	5.8	1.6	1.6	2.3
11					11	2.3	7.0	2.3	3.8	1.0	1.6	1.0
12					7.0	2.3	16	2.3	3.0	1.0	2.3	3.0
13				4.8	5.8	2.3	8.2	3.0	3.0	1.0	12	2.3
14				4.8	5.8	2.3	7.0	7.0	1.6	1.6	4.8	1.6
15				4.8	5.8	2.3	11	4.8	3.0	2.3	3.0	1.6
16				4.8	5.8	2.3	7.0	5.8	9.6	4.8	3.0	1.6
17				4.8	5.8	2.3	8.2	3.0	4.8	3.0	2.3	1.6
18				4.8	4.8	3.0	8.2	3.8	3.8	2.3	1.6	1.6
19				5.8	4.8	3.0	12	3.8	2.3	1.6	1.6	20
20				5.8	3.8	8.2	14	3.8	3.0	3.0	1.6	9.6
21				8.2	3.8	5.8	11	4.8	3.0	8.2	1.0	[b] 5.0
22				5.8	3.8	7.0	5.8	20	3.0	3.8	1.0	[b] 5.0
23				5.8	3.8	4.8	4.8	14	2.3	4.8	1.6	[b] 5.0
24				5.8	3.0	3.8	3.8	16	3.0	8.2	1.0	[b]100
25				4.8	3.0	5.8	3.8	8.2	3.0	11	.6	[b]100
26				4.8	3.0	3.8	5.8	4.8	2.3	14	1.0	[b]100
27				12	3.0	3.0	23	3.0	2.3	7.0	1.0	[c]230
28				7.0	3.0	3.0	11	3.0	2.3	18	1.0	[b] 50
29				5.8	3.8	4.8	18	3.8	3.8	7.0	1.0	[b] 50
30				23	3.0	3.8	8.2	3.8	5.8	4.8	1.0	[b]100
31					3.0		5.8	3.8		5.8		[b]100

[a] Discharge interpolated.
[b] Discharge estimated.
[c] Discharge estimated with high-water mark as guide.

Daily discharge, in second-feet, of Mohihi Stream near Waimea, Kauai, for 1909–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1		a 8.0	3.8	b 22	5.8							
2		a 8.0	b 12	b 30	4.8						c 67	
3		8.2	b 21	38	b 5.4							
4		8.2	29	b 27	b 6.0							
5		7.0	b 20	b 17	b 6.6							4.8
6		7.0	9.6	5.8	b 7.2							
7		5.8	7.0	7.0	b 7.6		3.8					
8	7.0	5.8	4.8	7.0	8.2							
9	b 6.4	b 14	b 4.7	5.8	b 7.5			2.3				
10	5.8	23	b 4.5	b 4.8	b 6.9							
11	5.8	12	b 4.3	3.8	b 6.2							
12	11	11	b 4.1	3.8	b 5.5							
13	77	16	b 3.9	3.8	4.8			2.3			3.8	
14	16	12	3.8	b 3.5	3.8							
15	11	12	3.0	b 3.2	3.8			1.6				
16	16	11	3.0	3.0	4.8					2.3		
17	42	7.0	3.0	18	4.8							
18	62	5.8	3.0	8.2	b 4.8							
19	23	5.8	3.0	7.0	b 4.8						3.0	
20	29	4.8	b 3.0	b 6.6	b 4.8							
21	67	4.8	3.0	b 6.2	b 4.8		3.0			3.0		
22	a 10	4.8	3.8	5.8	4.8							
23	a 10	4.8	26	8.2	b 4.3							
24	a 10	a 4.8	23	b 12	3.8			3.0				
25	a 10	4.8	11	b 16	b 3.6						2.3	
26	a 10	3.8	5.8	20	b 3.4			5.8				
27	a 10	3.8	b 6.4	b 14	b 3.2	5.8						
28	a 10	3.8	7.0	7.0	3.0							
29	a 10		11	b 6.4	a 3.0							
30	a 10		5.8	5.8	a 3.0					5.8		
31	a 10		b 14		a 3.0							
1911.												
1				35			4.8		2.3			
2							4.8					
3						23						
4			14					2.3				
5					5.8							
6	9.6											
7				8.2			3.8					
8									2.3			
9						8.2						
10			50									
11								2.3				
12					7.0							
13	11									2.3		
14				5.8			2.3					
15									2.3			
16						5.8						
17		11	23									
18								2.3				
19					8.2							
20												
21							3.8					
22				9.6					7.0			
23						5.8			11			
24												
25		11	26					2.3				
26					18							
27					50							
28				11			14					
29									4.8			
30												
31	4.8											

a Discharge estimated.
b Discharge interpolated.
c Discharge estimated with high-water mark as guide.

NOTE.—Daily discharge computed from a rating curve fairly well defined below 12 second-feet. No record for days on which discharge is omitted.

Monthly discharge of Mohihi Stream near Waimea, Kauai, for 1909–10.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1909.					
April 13–30	23	4.8	6.86	245	B.
May	42	3.0	7.28	448	B.
June	8.2	2.3	3.41	203	B.
July	23	3.8	8.85	544	B.
August	20	2.3	5.20	320	B.
September	9.6	1.6	3.71	221	B.
October	18	1.0	4.38	269	B.
November	12	.6	2.70	161	B.
December	[a] 230	1.0	30.9	1,900	D.
The period				4,310	
1910.					
January 8–31	77	5.8	20.0	952	D.
February	23	3.8	8.14	452	B.
March	29	3.0	8.61	529	C.
April	38	3.0	10.9	649	C.
May	8.2	3.0	4.97	306	C.

[a] Estimated.

NOTE.—After May, 1910, the data were insufficient for an estimate.

WAIALAE STREAM NEAR WAIMEA, KAUAI.

The Waialae basin lies south of the Koaie basin, which separates it from the Mohihi basin on the north. It is 9 or 10 miles long and reaches almost to the top of Waialeale. Its width ranges from less than 1 mile in the upper part to 2 miles near its mouth. The Waialae basin differs from the Koaie basin in being longer but narrower and not so deep except near its mouth. The stream bed is above 3,000 feet for the greater part of its course, whereas the Koaie runs through a long deep canyon which reaches well back toward its source.

A station was established on Waialae Stream August 1, 1910, at 3,500 feet elevation. It is about 3 miles by trail north of Gay's mountain house and a few hundred feet above the first trail crossing. A Barrett & Lawrence 34-day hydro-chronograph is used for obtaining gage heights and a cable with car is used for making high-water measurements. The width of channel at low water is about 40 feet, and the extreme range of stage is about 5 feet.

Discharge measurements of Waialae Stream near Waimea, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 8	W. F. Martin	5.1	3.69	1.02	4.19
Nov. 10	Martin and Mendes	37.0	90	1.21	7.9
Do.	do.	13.9	24.6	1.21	10.0
1911.					
Apr. 25	W. F. Martin	37.0	107	1.53	28.6
26	do.	15.4	23.0	1.32	14.6
Sept. 12	Hardy and Horner	24	16.6	1.34	14.6
13	W. V. Hardy	24	11.7	1.18	7.8
Oct. 16	do.	4.3	3.66	1.08	3.90
Dec. 5	do.	4.2	3.81	1.12	4.20

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Waialae Stream near Waimea, Kauai, for 1910–11.

[D. Fraser, J. E. Mendes, and D. E. Horner, observers.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.						1910.					
1	1.05	1.05	1.16	1.00	1.50	16	1.00	1.15	1.12	1.20	1.03
2	1.05	1.03	1.16	1.00	1.50	17	1.00	1.14	1.10	1.18	1.04
3	1.05	1.02	1.15	1.02	1.45	18	1.00	1.09	1.02	1.18	1.03
4	1.20	1.02	1.16	1.04	1.32	19	1.00	1.04	1.01	1.20	1.02
5	1.50	1.02	1.17	1.06	1.20	20	1.00	1.04	1.00	1.20	1.01
6	1.30	1.02	1.18	1.08	1.20	21	1.40	1.03	1.00	1.20	1.01
7	1.20	1.01	1.17	1.10	1.25	22	1.20	1.02	1.00	1.20	1.01
8	1.12	1.01	1.42	1.10	1.24	23	1.02	1.10	1.20	1.20	1.30
9	1.08	1.16	1.40	1.10	1.20	24	1.02	1.12	1.20	1.20	1.52
10	1.06	1.22	1.36	1.25	1.16	25	.....	1.13	1.09	1.22	1.52
11	1.05	1.10	1.22	1.50	1.10	26	.....	1.12	1.03	1.20	1.52
12	1.03	1.05	1.36	1.30	1.08	27	.....	1.30	1.43	1.18	1.56
13	1.02	1.06	1.38	1.22	1.06	28	.....	1.21	1.50	1.15	1.38
14	1.01	1.10	1.30	1.20	1.04	29	.....	1.18	1.32	1.22	1.40
15	1.01	1.11	1.18	1.20	1.03	30	.....	1.12	.....	1.40	1.50
						31	.....	.....	.....	.....	1.30

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	.....	.....	1.45	.....	1.26	.....	.....	.....	.....	.....	.....	.....
2	.....	.....	1.44	.....	1.26	.....	.....	.....	.....	.....	.....	.....
3	.....	.....	1.42	.....	1.26	.....	.....	.....	.....	.....	.....	.....
4	1.50	1.50	1.42	.....	1.28	.....	.....	.....	.....	.....	.....	1.16
5	1.50	1.60	1.40	.....	1.24	.....	.....	.....	.....	.....	.....	1.10
6	1.50	1.60	1.40	.....	1.24	.....	.....	.....	.....	.....	.....	1.35
7	1.52	1.60	.....	.....	1.23	.....	.....	.....	.....	.....	.....	1.25
8	1.52	1.60	.....	.....	1.22	.....	.....	.....	.....	.....	.....	1.90
9	1.50	1.60	.....	.....	1.52	.....	.....	.....	.....	.....	.....	1.85
10	1.50	1.60	.....	.....	1.40	1.50	.....	.....	.....	.....	.....	1.45
11	1.50	1.60	.....	.....	1.22	.....	.....	.....	.....	.....	.....	1.65
12	1.45	1.54	.....	.....	1.20	.....	.....	.....	1.30	.....	.....	1.50
13	1.44	1.45	.....	.....	1.30	.....	.....	.....	1.18	.....	.....	1.40
14	1.30	1.42	.....	.....	.....	.....	.....	.....	1.18	.....	.....	1.40
15	1.40	1.40	.....	.....	.....	.....	.....	.....	1.35	.....	1.94	2.20
16	1.50	1.38	.....	.....	.....	.....	.....	.....	1.32	1.08	.....	1.80
17	1.50	1.34	.....	.....	.....	.....	.....	.....	1.50	.....	.....	1.50
18	1.50	1.32	.....	.....	.....	.....	.....	.....	1.50	.....	.....	1.40
19	1.45	1.28	.....	.....	.....	.....	.....	.....	1.40	.....	.....	1.38
20	1.40	1.30	.....	.....	.....	.....	.....	.....	1.30	.....	.....	1.36
21	1.38	1.30	.....	.....	.....	.....	.....	.....	1.65	.....	.....	1.35
22	1.42	1.40	.....	.....	.....	.....	.....	.....	1.55	.....	.....	1.60
23	1.52	1.65	.....	.....	.....	.....	.....	.....	1.50	.....	.....	1.50
24	1.50	1.55	.....	.....	1.26	.....	.....	.....	.....	.....	.....	1.22
25	1.40	1.15	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.21
26	1.40	1.70	.....	1.36	.....	.....	.....	.....	.....	.....	.....	1.17
27	.....	1.65	.....	1.38	.....	1.60	.....	.....	.....	.....	.....	1.12
28	.....	1.55	.....	1.35	.....	.....	.....	.....	.....	.....	.....	1.14
29	.....	.....	.....	1.32	.....	.....	.....	.....	.....	.....	.....	1.50
30	.....	.....	.....	1.30	.....	.....	.....	.....	.....	.....	1.20	1.35
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.16

Daily discharge, in second-feet, of Waialae Stream near Waimea, Kauai, for 1910–11.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1		4.0	4.0	6.4	3.6	26	16		3.6	6.0	5.1	8.0	3.8
2		4.0	3.8	6.4	3.6	26	17		3.6	5.7	4.7	7.2	3.9
3		4.0	3.7	6.0	3.7	23	18		3.6	4.5	3.7	7.2	3.8
4		8.0	3.7	6.4	3.9	14	19		3.6	3.9	3.6	8.0	3.7
5		26	3.7	6.8	4.1	8.0	20		3.6	3.9	3.6	8.0	3.6
6		13	3.7	7.2	4.3	8.0	21		19	3.8	3.6	8.0	3.6
7		8.0	3.6	6.8	4.7	10	22		8.0	3.7	3.6	8.0	3.6
8		5.1	3.6	21	4.7	10	23		3.7	4.7	8.0	8.0	13
9		4.3	6.4	19	4.7	8.0	24		3.7	5.1	8.0	8.0	28
10		4.1	9.0	17	10	6.4	25		a3.7	5.4	4.5	9.0	28
11		4.0	4.7	9.0	26	4.7	26		a3.8	5.1	3.8	8.0	28
12		3.8	4.0	17	13	4.3	27		a3.8	5.4	21	7.2	31
13		3.7	4.1	18	9.0	4.1	28		a3.9	8.5	26	6.0	18
14		3.6	4.7	13	8.0	3.9	29		a3.9	7.2	14	9.0	19
15		3.6	4.9	7.2	8.0	3.8	30		a3.9	5.1	a10	19	26
							31		a4.0		a7		13

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	a16	a24	23		11						8.5	a7.6
2	a19	a25	22		11						8.0	a7.2
3	a22	a26	21		11						7.6	a6.8
4	26	26	21		12						4.7	6.4
5	26	34	19		10						4.7	4.7
6	26	34	19		10						6.4	16
7	28	34			9.5						9.0	10
8	28	34			9.0						13	58
9	26	34			28						19	54
10	26	34			19	26					23	23
11	26	34			9.0						30	38
12	23	29			8.0				13		34	26
13	22	23			13				7.2		42	19
14	13	21							7.2		48	19
15	19	19							16		62	88
16	26	18							14	4.3	a59	50
17	26	15							26	4.7	a55	26
18	26	14							26	5.1	a52	19
19	23	12							19	5.1	a48	18
20	19	13							13	5.7	a45	17
21	18	13							38	6.4	a41	16
22	21	19							30	7.2	a38	34
23	28	38							26	8.0	a34	26
24	26	30			11					10	a31	9.0
25	19	6.0								13	a27	8.5
26	19	42		17						16	a24	6.8
27	a20	38		18		34				19	a20	5.1
28	a21	30		16						12	a16	5.7
29	a22			14						11	a12	26
30	a23			13						10	8.0	16
31	a23									9.0		6.4

a Discharge interpolated.

NOTE.—Discharge estimated from Oct. 17 to Nov. 14, 1911, the estimate being based on gage readings of Oct. 16 and Nov. 15, and upon discharge of Waimea River. No record for the days on which discharge is missing. Daily discharge computed from a rating curve fairly well defined between 3.5 and 30 second-feet.

Monthly discharge of Waialae Stream near Waimea, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
August	26	3.6	5.76	354	B.
September	9	3.6	4.85	289	B.
October	26	3.6	9.60	590	B.
November	26	3.6	8.00	476	B.
December	31	3.6	12.6	775	B.
1911.					
January	28	13	22.8	1,400	B.
February	42	6	25.7	1,430	B.
October 16–31			9.16	291	
November			27.7	1,650	
December	88	4.7	21.7	1.330	B.

NOTE.—Data insufficient for an estimate from March to September, inclusive, 1911.

KEKAHA DITCH AT INTAKE NEAR WAIMEA, KAUAI.

Kekaha ditch diverts water from the east side of Waimea River about 8 miles from the sea at 550 feet elevation. The ditch is on the east side for 4½ miles then crosses the river in an inverted siphon. The water is used for irrigating cane on the plantation of the Kekaha Sugar Co.

A gaging station was established on this ditch about 700 feet below the intake December 1, 1910. The station is at an open section of the ditch and the equipment consists of a staff gage graduated in tenths of feet and a board graduated in feet from which measurements are made. About 200 feet below the station is a low weir with poor contractions and high velocity of approach. Measurements at the station have been used to rate the weir so that observed heads on the weir could be used to obtain the daily flow at the station. The company has kindly furnished to the Geological Survey the weir readings for 1910 and 1911, and also has instructed its ditchman, Manuel de Arruda, to read the gage at the regular station for the Survey.

Discharge measurements of Kekaha ditch at intake, near Waimea, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 11	Martin and Mendes	10.7	36.0	(a)	88
1911.					
Apr. 27	W. F. Martin	11.0	35.8	b 3.57	86
Nov. 15	W. V. Hardy	10.5	35.9	c 3.57	85

a Head on 8-foot weir below station was 26½ inches.
b Head on 8-foot weir below station was 26½ inches.
c Head on 8-foot weir below station was 26 inches.

Daily gage height, in inches, of Kekaha ditch at intake, near Waimea, Kauai, for 1910–11.

[Kekaha Sugar Co., observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	12	21	20½	29	23½	28	26	17	15	19½	20	25
2	12	21	20½	29	23	28	22	17	15	19½	15	25
3	18	21	20½	29½	25	28	20	16	15	22	15	25
4	18	21	20	29½	23½	28	.....	16	15	22½	15	25
5	18	21	.....	29½	27½	25½	26	26	15	17½	25	25
6	18	21	.....	29½	28	24	22	28	14½	17	25	25
7	18	21	.....	29½	29	21	20	20	14	19¾	25	25
8	18	21	.....	29½	29	21	19	17¾	15	21¾	25	25
9	18	21	.....	29½	29	28	18	17	17¼	25½	25	24½
10	18	21	.....	26	29	28	18	17	23½	25½	26½	22½
11	18	21	.....	24	28	28	18	17	21¾	24	27	21¼
12	18	21	20	22	28	28	24	17	15½	21¼	26	20
13	18	21	19½	20	.....	28	25	15	17	27¼	27	18¾
14	18	21	19½	20	.....	28	20½	15	23	23	25	18
15	18	21	19	19½	.....	28	26	15	23	18	23	17½
16	18	21	18½	19	.....	28	27	15½	23½	17	20¾	17
17	18	21	18½	19	.....	28	20	15½	22½	16	20	17
18	18	21	18½	29½	20	28	18	16	18	15½	19½	17
19	18	21	19	28½	24	28	21	15	19½	15	19	16½
20	18	21	20½	27¾	24	28	19	15	21	15	19	16
21	18	21	23½	29½	24	28	25	27	24½	15	18	16
22	18	21	26¾	29½	24	28	19½	25½	24	18	18	16
23	18	21	29	29½	23	28	18	19	27	18	21½	16
24	18	21	29	29½	22	25	20½	16½	27	23	24½	25
25	18	21	29	29½	20	27	24	26¾	20	18	24½	25
26	18	21	27	29	19½	28	20½	20¾	25	16	27	25
27	18	21	28	29½	19½	28	19	20½	26	27	25	25
28	18	20½	29	29½	18½	25	21	19½	27	26	24	25
29	18	.....	29	28½	21	27	25	18	26½	27	25	25
30	21	.....	29	25½	28	27	20	17	19½	26½	25	22
31	21	.....	28½	.....	28	.....	17½	16	.....	23	.....	18
1911.												
1	15	16	20	12	25	25	25	19	21	26	15	19¼
2	20	16	20	12	25	25	23	19	18	25	15	18
3	25	16	20	15	25	25	22	18	16½	22	15	17
4	25	16	20	18	25	25	24	18	16	21¾	14¾	17
5	25	24	20	18	25	25	25	18	16½	26	14½	17
6	25	24	20	20	25	25	25	17	16	23½	17¼	21½
7	23½	24	21¾	22	25	25	25	17	18	25¾	17	22½
8	16½	24	22	22	25	25	22	16	21	24½	18	24½
9	.....	24	22	22	25	25	21	16	26	21	20¾	26
10	.....	24	22	22	25	25	19	16	25	18¾	21	26
11	.....	24	22	21	25	25	25	16	25½	17¾	18½	25
12	.....	24	22	22	25	25	23	16	24½	17¼	19¾	26
13	.....	24	22	22	25	24	22	18	24	17	21¾	26¼
14	.....	24	22	22	25	25	21	17	18½	16½	26	27
15	.....	24	22	22	25	25	22	18	21¾	16	26	27
16	.....	24	22	22	25	25	19	17	23½	15½	25½	27
17	.....	24	22	22	25	22	24	18	25½	15½	25	27
18	.....	24	12	22	25	21	25	17½	26	15½	26	27
19	.....	24	12	24	25	20	22	17	26	15¼	26	27
20	.....	24	12	25	25	22	21	20½	24½	15	26	26½
21	16	24	12	25	25	22	20	22	26	16¼	26	25¾
22	16	24	12	25	25	25	25½	17½	26	16¼	26	25¾
23	16	24	16	25	25	25	26	16	26	17½	26	27
24	16	20	20	25	25	25	24	16	22½	26	24	26½
25	16	20	16	24	25	25	21	15	25½	25½	21¾	23¼
26	16	20	12	25	22	25	19	15	25¼	21	19½	21¼
27	16	20	12	25	25	25	19	20	26	17¾	24	20¼
28	16	20	12	25	25	25	21½	21	25½	16¼	25¾	19½
29	16	.....	12	25	25	25	25	18	26	16	22½	27
30	16	.....	12	25	25	23	25	17	23	15¾	21½	26¾
31	16	.....	12	.....	25	.....	21	17	.....	15¼	.....	23

NOTE.—Ditch dry on days for which gage height is not given.

Daily discharge, in second-feet, of Kekaha ditch at intake, near Waimea, Kauai, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	27	62	60	100	73	95	85	45	37	55	57	80
2	27	62	60	100	71	95	66	45	37	55	37	80
3	49	62	60	102	80	95	57	41	37	66	37	80
4	49	62	57	102	73	95	.....	41	37	68	37	80
5	49	62	.....	102	92	82	85	85	37	47	80	80
6	49	62	.....	102	95	75	66	95	36	45	80	80
7	49	62	.....	102	100	62	57	57	34	56	80	80
8	49	62	.....	102	100	62	53	48	37	65	80	80
9	49	62	.....	102	100	95	49	45	46	82	80	78
10	49	62	.....	85	100	95	49	45	73	82	88	68
11	49	62	.....	75	95	95	49	45	65	75	90	63
12	49	62	57	66	95	95	75	45	40	63	85	57
13	49	62	55	57	.....	95	80	37	45	91	90	52
14	49	62	55	57	.....	95	60	37	71	71	80	49
15	49	62	53	55	.....	95	85	37	71	49	71	47
16	49	62	51	53	.....	95	90	39	73	45	60	46
17	49	62	51	53	.....	95	57	39	68	41	57	45
18	49	62	51	102	57	95	49	41	49	39	55	45
19	49	62	53	98	75	95	62	37	54	37	53	43
20	49	62	60	94	75	95	53	37	62	37	53	41
21	49	62	73	102	75	95	80	90	78	37	49	41
22	49	62	89	102	75	95	55	82	75	49	49	41
23	49	62	100	102	71	95	49	53	90	49	64	41
24	49	62	100	102	66	80	60	43	90	71	78	80
25	49	62	100	102	57	90	75	89	57	49	78	80
26	49	62	90	100	55	95	60	61	80	41	90	80
27	49	62	95	102	55	95	53	60	85	90	80	80
28	49	60	100	102	51	80	62	55	90	85	75	80
29	49	.....	100	98	62	90	80	49	88	90	80	80
30	62	.....	100	82	95	90	57	45	55	88	80	66
31	62	.....	98	.....	95	.....	47	41	.....	71	.....	49
1911.												
1	37	41	57	27	80	80	80	53	62	85	37	54
2	57	41	57	27	80	80	71	53	49	80	37	49
3	80	41	57	37	80	80	66	49	43	66	37	45
4	80	41	57	49	80	80	75	49	41	65	36	45
5	80	75	57	49	80	80	80	49	43	85	35	45
6	80	75	57	57	80	80	80	45	41	73	46	64
7	73	75	64	66	80	80	80	45	49	84	45	68
8	43	75	66	66	80	80	66	41	62	78	49	78
9	.....	75	66	66	80	80	62	41	85	62	61	85
10	.....	75	66	66	80	80	53	41	80	52	62	85
11	.....	75	66	62	80	80	80	41	82	48	50	80
12	.....	75	66	66	80	80	71	41	78	46	56	85
13	.....	75	66	66	80	75	66	49	75	45	65	86
14	.....	75	66	66	80	80	62	45	50	43	85	90
15	.....	75	66	66	80	80	66	49	65	41	85	90
16	.....	75	66	66	80	80	53	45	73	39	82	90
17	.....	75	66	66	80	66	75	49	82	39	80	90
18	.....	75	27	66	80	62	80	47	85	39	85	90
19	.....	75	27	75	80	57	66	45	85	38	85	90
20	.....	75	27	80	80	66	62	60	78	37	85	88
21	41	75	27	80	80	66	57	66	85	42	85	84
22	41	75	27	80	80	80	82	47	85	42	85	84
23	41	75	41	80	80	80	85	41	85	47	85	90
24	41	57	57	80	80	80	75	41	68	85	75	88
25	41	57	41	75	80	80	62	37	82	82	65	72
26	41	57	27	80	66	80	53	37	81	62	55	63
27	41	57	27	80	80	80	53	57	85	48	75	58
28	41	57	27	80	80	80	64	62	82	42	84	55
29	41	.....	27	80	80	80	80	49	85	41	68	90
30	41	.....	27	80	80	71	80	45	71	40	64	89
31	41	.....	27	.....	80	.....	62	45	.....	38	.....	71

NOTE.—Discharge computed from records of head on an 8-foot weir, using weir formula with corrections determined by current-meter measurements.

Monthly discharge of Kekaha ditch at intake, near Waimea, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	62	27	48.4	2,980	A.
February	62	60	61.9	3,440	A.
March 1–4 and 12–31	100	51	73.7	3,500	A.
April	102	53	90.1	5,360	A.
May 1–12 and 18–31	100	51	78.4	4,040	A.
June	95	62	90.2	5,370	A.
July 1–3 and 5–31	85	47	63.5	3,780	A.
August	95	37	51.9	3,190	A.
September	90	34	59.9	3,560	A.
October	91	37	61.0	3,750	A.
November	90	37	69.1	4,110	A.
December	80	41	64.3	3,950	A.
The period	102	27	67.4	47,000	
January 1–8 and 21–31	80	37	51.6	1,940	A.
February	75	41	66.9	3,720	A.
March	66	27	48.5	2,980	A.
April	80	27	66.1	3,930	A.
May	80	66	79.5	4,890	A.
June	80	57	76.8	4,570	A.
July	80	53	69.3	4,260	A.
August	66	37	47.2	2,900	A.
September	85	41	70.6	4,200	A.
October	85	37	55.3	3,400	A.
November	85	35	64.8	3,860	A.
December	90	45	75.5	4,640	A.
The period	90	27	66.0	45,300	

NOTE.—Minimum and mean discharges are only for days when ditch was carrying water. The ditch was dry during the periods Mar. 5–11, May 13–17, and July 4, 1910; and Jan. 9–20, 1911. The table shows the quantity of water taken from Waimea River by the Kekaha ditch.

KEKAHA DITCH AT FLUME NO. 3, NEAR WAIMEA, KAUAI.

Flume No. 3 on Kekaha ditch is about 2 miles below the intake. A gage graduated in tenths of feet was set December 1, 1910, by the Kekaha Sugar Co., and was read daily by the ditchman for the Geological Survey. Measurements are made from a tie beam 2 feet above the gage. The records at this station, in connection with the station at the intake, are valuable in determining seepage losses.

Discharge measurements of Kekaha ditch at flume No. 3, near Waimea, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 27	W. F. Martin	8.0	22.3	2.72	89
Nov. 15	W. V. Hardy	8.0	22.8	2.78	83

Daily gage height, in feet, of Kekaha ditch at flume No. 3, near Waimea, Kauai, for 1910–11.

[Manuel de Arruda, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	2.5	11	2.02	21	1.45
2	2.5	12	1.88	22	1.4
3	2.5	13	1.75	23	1.4
4	2.5	14	1.65	24	2.45
5	2.5	15	1.6	25	2.45
6	2.5	16	1.58	26	2.45
7	2.5	17	1.55	27	2.45
8	2.45	18	1.55	28	2.45
9	2.40	19	1.5	29	2.45
10	2.15	20	1.45	30	1.70
				31	2.25

Day.	Jan.	Feb.	Mar.	Oct.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Oct.	Nov.	Dec.
1911.							1911.						
1	1.25	1.45	1 9	2.65	1.5	1.95	16	0	2.4	2.2	1.55	2.7	2.8
2	1.85	1.45	1.9	2.5	1.5	1.79	17	0	2.4	2.2	1.55	2.75	2.8
3	2.45	1.45	1.9	2.25	1.5	1.7	18	0	2.4	1.1	1.55	2.74	2.8
4	2.45	1.45	1.9	2.2	1.48	1.7	19	0	2.4	1.1	1.55	2.77	2.8
5	2.45	2.40	1.9	2.65	1.45	1.7	20	0	2.4	1.1	1.5	2.75	2.76
6	2.45	2.4	1.9	2.35	1.88	2.24	21	1.48	2.4	1.1	1.62	2.75	2.68
7	2.02	2.4	2.0	2.62	1.7	2.32	22	1.45	2.4	1.1	1.62	2.75	2.66
8	1.32	2.4	2.2	2.45	1.8	2.7	23	1.45	2.4	1.1	1.58	2.75	2.8
9	0	2.4	2.2	2.18	2.18	2.75	24	1.45	1.9	1.9	2.75	2.51	2.78
10	0	2.4	2.2	1.85	2.1	2.75	25	1.45	1.9	1.9	2.7	2.25	2.4
11	0	2.4	2.2	1.78	1.85	2.6	26	1.45	1.9	.....	2.18	2.0	2.16
12	0	2.4	2.2	1.72	2.0	2.72	27	1.45	1.9	1.1	1.82	2.48	2.02
13	0	2.4	2.2	1.70	1.72	2.71	28	1.45	1.9	.....	1.65	2.65	1.95
14	0	2.4	2.2	1.65	2.72	2.8	29	1.45	.....	.....	1.65	2.28	2.8
15	0	2.4	2.2	1.6	2.78	2.8	30	1.45	.....	.....	1.62	2.15	2.78
							31	1.45	.....	.....	1.58	.....	2.39

NOTE.—No readings were obtained from Mar. 28 to Sept. 30, 1911. Daily discharge will be published later when enough measurements for a rating have been made.

KEKAHA DITCH ABOVE SIPHON, NEAR WAIMEA, KAUAI.

Kekaha ditch crosses the river in an inverted siphon 4½ miles below the intake. Just above the mouth of the siphon in the open ditch a gaging station has been established.

The gage, graduated in tenths of feet, was set December 1, 1910, by the Kekaha Sugar Co., and was read daily for the Geological Survey by the plantation ditchman. Measurements are made from a portable plank used as a footbridge.

The records at this point, in connection with those at the stations above, are valuable in determining seepage losses. They also show how much water is taken from the river to the west side.

Discharge measurements of Kekaha ditch above siphon, near Waimea, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 28	Martin, Pierce, and Mendes	10.6	46.0	.....	82
Nov. 11	Martin and Mendes	10.4	43.3	.....	78
1911.					
Feb. 15	Martin and Hoyt	10.0	35.2	3.60	74
Apr. 27	W. F. Martin	13.3	54	5.15	82
Nov. 15	W. V. Hardy	10.7	51	5.06	80

Daily gage height, in feet, of Kekaha ditch above siphon, near Waimea, Kauai, for 1910–11.

[Manuel de Arruda, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	5.30	11	1.85	21	1.40
2	3.90	12	1.68	22	1.40
3	3.70	13	1.58	23	1.40
4	3.40	14	1.55	24	3.40
5	3.02	15	1.50	25	3.55
6	2.80	16	1.48	26	3.65
7	2.95	17	1.45	27	3.80
8	2.56	18	1.45	28	3.05
9	2.35	19	1.40	29	2.75
10	2.00	20	1.40	30	2.65
				31	2.60

Day.	Jan.	Feb.	Mar.	Oct.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Oct.	Nov.	Dec.
1911.							1911.						
1	1.50	1.50	1.80	4.80	1.35	1.64	16	0	3.20	2.00	1.40	4.35	5.30
2	1.50	1.45	1.80	4.60	1.30	1.55	17	0	3.20	2.00	1.40	4.28	5.20
3	3.10	1.50	1.80	3.40	1.30	1.48	18	0	3.20	1.20	1.40	4.48	5.16
4	2.25	1.50	1.80	1.80	1.30	1.40	19	0	3.05	1.20	1.38	5.12	4.85
5	3.40	3.00	1.80	3.70	1.30	1.45	20	0	2.80	1.20	1.35	4.95	4.55
6	3.85	3.00	1.80	2.45	1.62	2.82	21	1.40	3.15	1.20	1.35	5.02	3.90
7	2.50	3.78	1.80	3.65	1.58	1.95	22	1.50	3.20	1.10	1.55	4.50	3.41
8	2.20	3.80	1.90	2.70	1.65	3.30	23	1.50	2.70	1.45	1.48	4.40	4.55
9	0	4.22	2.00	1.85	1.92	4.48	24	1.50	1.90	1.80	5.20	2.80	4.35
10	0	4.08	2.00	1.68	2.95	3.80	25	1.50	1.90	1.80	4.50	1.85	2.15
11	0	3.90	2.00	1.62	1.65	3.55	26	1.50	1.80	.....	1.85	1.64	1.88
12	0	3.80	2.00	1.58	1.85	4.50	27	1.50	1.80	.....	1.62	2.48	1.76
13	0	3.70	2.00	1.50	1.55	4.02	28	1.50	1.80	.....	1.50	3.42	1.68
14	0	3.15	2.00	1.48	4.80	3.85	29	1.50	.....	.....	1.40	1.92	5.25
15	0	3.30	2.00	1.40	4.85	5.25	30	1.50	.....	.....	1.40	1.86	4.72
							31	1.42	.....	.....	1.38	.....	2.45

NOTE.—No readings were obtained from Mar. 26 to Sept. 30, 1911. Daily discharge will be published later when enough measurements for a rating have been made.

KEKAHA DITCH AT WEIR BELOW TUNNEL NO. 12, NEAR WAIMEA, KAUAI.

Tunnel No. 12 weir on Kekaha ditch is several miles below the river siphon and a considerable distance below tunnel No. 12. The weir is low and has poor contractions with high velocity of approach, but it has been rated by means of meter measurements. The plantation keeps a daily record of the head on the weir and has kindly furnished the Geological Survey with the records for 1910 and 1911.

The discharge at this point shows how much water is delivered to the boundary of the plantation, exclusive of seepage losses and the amount supplied to the town of Waimea at times.

Discharge measurements of Kekaha ditch at weir below tunnel No. 12, near Waimea, Kauai, 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 28[a]	W. F. Martin	8.0	26.6	3.38	73.3
28	.....do	9.3	29.2	[b] 2.50	73.3
Oct. 20	Hardy and Hansen	8.5	24.7	[b] 1.46	34.8
Nov. 10	Hardy and Nordmeier	8.6	28.0	[b] 1.75	44.3

[a] Measurement made at upper end of tunnel No. 12, about ½ mile above weir.
[b] Head on 6-foot weir.

Daily gage height, in inches, of Kekaha ditch at weir below tunnel No. 12, near Waimea, Kauai, for 1910–11.

[Kekaha Sugar Co., observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	10	20½	20	29	22	29	.....	18	16	21	25	30
2	10	21½	19	28½	21½	29	24	17	15	21	16	30
3	21	21½	19	27½	23	29	24	17	15	22½	16	28½
4	21	21	19	26½	22	28½	.....	16¾	15	24½	16	28½
5	18	21	.....	25½	23	27½	24	29½	15	21	29½	28
6	18	21	.....	25½	25½	26	24	29½	15½	19½	26½	28½
7	20½	21	.....	26	25	21	21	24½	15	22	28½	28
8	18	21	.....	25½	26	22¾	20½	19½	15	28	28	28
9	15	21	.....	25	27	29½	19½	10	17	29	27½	26½
10	15	21	.....	21	27	29½	19	17	25	29	28½	26
11	19	21	.....	20½	26½	28	19½	17½	18	27	29½	22½
12	20	21¾	18½	20½	26½	29	26	16¾	16	21	29½	22
23	20	21	19	19	.....	29½	28	16	20½	28½	27½	21
14	18	21	19½	19	.....	28½	24	16	24	28½	25½	20
15	19	20	19¾	18¾	.....	29½	26¼	16	28	18½	22½	20
16	20	20½	19½	18½	.....	28	27½	16¾	29½	18½	22½	19½
17	20	20	19½	22	.....	28½	21	17	28	18½	22	19
18	20	19	18½	27½	20	28½	19	16½	23	17	21½	18½
19	18	20½	18	26	24	28½	22	16¾	18¾	16½	21½	18
20	18	20½	20	24	27½	28½	21	16¾	20	16	20½	17½
21	18	20½	20	24	26½	28½	27	29½	28¾	16	20	16½
22	18½	20½	24	25	26	29	23	28	27½	18	20½	17½
23	18½	20½	28½	25	25	28½	23	22	29½	20	26	18½
24	18½	20½	27¾	25	23½	27	22	18	29½	25½	27	28
25	18½	22	27¾	27½	22	28½	25	16½	27½	20	28	28
26	17½	21	27¾	27¾	21	29	23	27	29½	17½	29½	29
27	17	20	25	26½	20¾	29	20	23½	29½	25	29½	29
28	17	20	27	26	20	27	25	21	29½	28	27	28
29	18	.....	29½	26½	20	29½	29	17	28½	29½	30	28
30	20½	.....	28	24	28	28½	26	16½	22½	29½	30	18
31	21½	.....	27	.....	29	.....	18	16½	.....	26½	.....	29
1911.												
1	18	19	26½	16	28½	30¼	30	22	19	28½	17½	20½
2	18	19	25	16	30	30	29	21½	21	27¾	16½	16
3	28	20	26	16	30	30	27½	22½	18½	24½	16½	19½
4	27	20	26	23½	29	30	29	20½	18½	22½	16½	19
5	29	29	25	23	29½	30	30	20	18½	27¼	16½	18½
6	27	29	24½	24	29	30	30	19	18	27¼	16½	18
7	29	29	26	26	30	30½	29½	18½	20½	27½	20	25½
8	30	29	26	26	30	30	29½	21	19½	25¼	19½	26½
9	.....	28	28	26	30	30	26	21	27	24¼	25½	29½
10	.....	29	27	26	30	30	24	20½	30	21½	21½	28
11	.....	28	26	27	29½	29	29	19	28½	20½	23½	26¾
12	.....	29	25	27	30	29½	29	20	29	19¾	26½	26¾
13	.....	29	25	27	29½	28½	28½	22	28½	19¼	19¾	26¾
14	.....	29	27	28	29	29½	27½	21½	22½	18¾	29½	26½
15	.....	29	26	28	29½	30	25½	21	20	18	29½	30½
16	.....	28	27	28	29¼	30	25	20½	28	18	30	30¼
17	.....	28½	27½	28	30	30	26	20	27½	17¾	29	30
18	.....	28½	19	27¾	30	26½	27	19½	29	16¾	28	30
19	.....	27½	.....	29	30	26½	23½	21½	28	17	29½	27
20	.....	27½	16	30	30	27½	25	23½	24½	16¾	29½	29
21	20	28½	16	30	29½	27¾	26	27	27¾	16¾	29½	29
22	20	28½	16	30	29	30¾	29½	21	27¾	18	29	27
23	20	28	15	30	29	30½	30	21	30¼	18½	28	28
24	20	12	23½	29½	30	30½	30	19	29¾	28½	26½	28
25	20	23	25	30	29	28½	26	19	28	29½	23½	27
26	20	26½	19	30	28	30½	25	18½	28¾	26½	21½	25
27	20	27½	18	29	29	30½	23	21¼	29¾	21½	23	22
28	20	28	16	30	30½	30¾	27	25	28¾	21	28	21½
29	20	.....	16	29	30	30½	28	20	29¾	19	22½	29
30	19	.....	16	29	30	30¾	28	18½	27¼	19	23½	29¾
31	19	.....	16	.....	30	.....	25	18½	.....	18	.....	26

NOTE.—Ditch dry on days for which gage height is not given.

Daily discharge, in second-feet, of Kekaha ditch at weir below tunnel No. 12, near Waimea, Kauai, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	16	42	41	70	47	70	60	36	31	44	57	73
2	16	46	39	68	46	70	53	34	29	44	31	73
3	44	46	39	64	50	70	53	34	29	48	31	68
4	44	44	39	62	47	68	.....	33	29	56	31	68
5	36	44	.....	58	50	64	53	72	29	44	72	66
6	36	44	.....	59	58	60	53	72	30	40	62	68
7	42	44	.....	60	57	44	44	54	29	47	68	66
8	36	44	.....	58	60	49	42	40	29	66	66	66
9	29	44	.....	57	63	72	40	16	34	70	64	62
10	29	44	.....	44	63	72	39	34	57	70	68	60
11	39	44	.....	42	62	66	40	35	36	63	72	48
12	41	46	38	42	62	70	60	33	31	44	72	47
13	41	44	39	39	.....	72	66	31	42	68	64	44
14	36	44	40	39	.....	68	53	31	53	68	58	41
15	39	41	40	38	.....	72	62	31	66	38	48	41
16	41	42	40	38	.....	66	64	33	72	38	48	40
17	41	41	40	47	.....	68	44	34	66	38	47	39
18	41	39	38	64	41	68	39	32	50	34	46	38
19	36	42	36	60	53	68	47	33	38	32	46	36
20	36	42	41	53	64	68	44	33	47	31	42	35
21	36	42	41	53	62	68	63	72	69	31	41	32
22	38	42	53	57	60	70	50	66	64	36	42	35
23	38	42	68	57	57	68	50	47	72	41	60	38
24	38	42	65	57	52	63	47	36	72	58	63	66
25	38	47	65	64	47	68	57	32	64	41	66	66
26	35	44	65	65	44	70	50	63	72	35	72	70
27	34	41	57	62	43	70	41	52	72	57	72	70
28	34	41	63	60	41	63	57	44	72	66	63	66
29	36	.....	72	62	41	72	70	34	68	72	73	66
30	42	.....	66	53	66	68	60	32	48	72	73	36
31	46	.....	63	.....	70	.....	36	32	.....	62	.....	70
1911.												
1	36	39	62	31	68	74	73	47	39	68	35	42
2	36	39	57	31	73	73	70	46	44	65	32	31
3	66	41	60	31	73	73	64	48	38	55	32	40
4	63	41	60	52	70	73	70	42	38	48	32	39
5	70	70	57	50	72	73	73	41	38	64	32	38
6	63	70	55	53	70	73	73	39	36	64	32	36
7	70	70	60	60	73	75	72	38	42	64	41	58
8	73	70	60	60	73	73	72	41	40	59	40	62
9	.....	66	66	60	73	73	60	41	63	54	58	71
10	.....	70	63	60	73	73	53	42	73	46	46	66
11	.....	66	60	63	72	70	70	39	68	42	52	62
12	.....	70	57	63	73	72	70	41	70	40	62	61
13	.....	70	57	63	72	68	68	47	68	39	40	62
14	.....	70	63	66	70	72	64	46	48	38	72	61
15	.....	70	60	66	72	73	58	44	41	36	72	76
16	.....	66	63	66	71	73	57	42	66	36	73	74
17	.....	68	64	66	73	73	60	41	64	36	70	73
18	.....	68	39	65	73	62	63	40	70	33	66	73
19	.....	64	35	70	73	62	52	46	66	34	72	63
20	.....	64	31	73	73	64	57	52	55	33	72	70
21	41	68	31	73	72	65	60	63	65	33	72	70
22	41	68	31	73	70	76	72	44	65	36	70	63
23	41	66	29	73	70	74	73	44	74	38	66	66
24	41	21	52	72	73	75	73	39	72	68	62	66
25	41	50	57	73	70	68	60	39	66	72	52	63
26	41	62	39	73	66	75	57	38	69	62	46	57
27	41	64	36	70	70	75	50	45	72	46	50	47
28	41	66	31	73	75	76	63	57	69	44	66	46
29	41	.....	31	70	73	75	66	41	72	39	48	70
30	39	.....	31	70	73	76	66	38	64	39	52	72
31	39	.....	31	.....	73	.....	57	38	.....	36	.....	60

NOTE.—Daily discharge computed from a rating curve well defined between 30 and 75 second-feet. The curve was obtained by rating a 6-foot weir. Records of head on the weir were furnished by the Kekaha Sugar Co.

Monthly discharge of Kekaha ditch at weir below tunnel No. 12, near Waimea, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
January	46	16	36.6	2,250	A.
February	47	39	43.1	2,390	A.
March 1–4 and 12–31	72	36	49.5	2,350	A.
April	70	38	55.1	3,280	A.
May 1–12 and 18–31	70	41	54.1	2,790	A.
June	72	44	66.8	3,970	A.
July 1–3 and 5–31	70	36	51.2	3,050	A.
August	72	16	40.7	2,500	A.
September	72	29	50.0	2,980	A.
October	72	31	50.1	3,080	A.
November	73	31	57.3	3,410	A.
December	73	32	54.6	3,360	
The period	73	16	50.7	35,400	
1911.					A.
January 1–8 and 21–31	73	39	48.6	1,830	A.
February	70	21	61.3	3,400	A.
March	66	29	49.3	3,030	A.
April	73	31	62.3	3,710	A.
May	75	66	71.8	4,410	A.
June	76	62	71.9	4,280	A.
July	73	52	64.4	3,960	A.
August	63	38	43.5	2,670	A.
September	74	36	58.5	3,480	A.
October	72	33	47.3	2,910	A.
November	73	32	53.8	3,200	A.
December	76	31	59.3	3,650	A.
The period	76	21	59.1	40,500	

NOTE.—Minimum and mean discharge given only for days when ditch was carrying water. The ditch was dry during the periods Mar. 5–11, May 13–17, and July 4, 1910; and Jan. 9–20, 1911.

WAIMEA DITCH NEAR WAIMEA, KAUAI.

Waimea ditch diverts water from the west side of Waimea River about 4 miles from the sea at 150 feet elevation. It is a comparatively small ditch and for the most part consists of semicircular metallic flume. The water is used for irrigating cane on the plantation of the Waimea Sugar Mill Co.

A station was established on this ditch about 300 feet below the intake November 4, 1911. The equipment consists of a staff gage, read daily, and a pole bridge from which measurements are made.

Discharge measurements of Waimea ditch near Waimea, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 28[a]	Martin, Pierce, and Mendes	3.2	3.1	.....	7.0
1911.					
Apr. 29[a]	W. F. Martin	3.2	3.3	.....	7.3
Nov. 4	W. V. Hardy	5.7	7.8	1.70	3.40
15	.....do	5.6	10.2	2.20	9.2

[a] Measurement made about 1½ miles below intake before station was established.

NOTE.—An additional measurement made early in 1912 was used in determining the rating.

Daily gage height, in feet, of Waimea ditch near Waimea, Kauai, for 1911.

[Honke, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		2.10	11		2.20	21	2.20	2.20
2		2.00	12		2.20	22	2.20	2.20
3		1.90	13		2.30	23	2.20	2.20
3	1.70	1.80	14		2.20	24	2.10	2.20
5		1.80	15	2.20	2.20	25	1.80	2.20
6		1.75	16	2.20	2.20	26	2.20	1.90
7		2.25	17	1.80	2.20	27	2.20	1.95
8		2.00	18	2.20	2.20	28	2.20	1.95
9		2.20	19	2.20	2.20	28	2.20	2.20
10		2.20	20	2.20	2.20	30	2.10	2.20
						31		2.10

Daily discharge, in second-feet, of Waimea ditch near Waimea, Kauai, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		7.8	11		9.2	21	9.2	9.2
2		6.5	12		9.2	22	9.2	9.2
3		5.3	13		11	23	9.2	9.2
4	3.4	4.3	14		9.2	29	7.8	9.2
5		4.3	15	9.2	9.2	25	4.3	9.2
6		3.8	16	9.2	9.2	26	9.2	5.3
7		10	17	4.3	9.2	27	9.2	5.9
8		6.5	18	9.2	9.2	28	9.2	5.9
9		9.2	19	9.2	9.2	29	9.2	9.2
10		9.2	20	9.2	9.2	30	7.8	9.2
						31		7.8

NOTE.—Daily discharge computed from a rating curve fairly well defined between 3 and 11 second-feet. This division is above the gaging station on Waimea River.

Monthly discharge of Waimea ditch near Waimea, Kauai, for Nov. 15 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 4 and 15–30	9.2	3.4	7.92	267	B.
December	11	3.8	8.06	496	B.

KAMENEHUNE DITCH NEAR WAIMEA, KAUAI.

Kamenehune ditch is an ancient auwai, or old native taro ditch. It diverts water from the west side of Waimea River about 3 miles above the town of Waimea and about 1 mile above the station on the river. The water is used for irrigating taro and rice in the lower part of Waimea Valley.

A gaging station was established on this ditch October 9, 1911, at a point almost exactly opposite the station on the river. The equipment consists of a staff gage, graduated in tenths of feet and read daily, and a board, graduated in feet, from which measurements are made.

Discharge measurements of Kamenehune ditch near Waimea, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 28[a]	Martin, Pierce, and Mendes	1.45	2.04	.....	2.06
Oct. 27[a]	J. E. Mendes	1.5	2.23	.....	2.13
1911.					
Apr. 29[a]	W. F. Martin	1.45	2.20	.....	1.96
Oct. 9	W. V. Hardy	3.5	2.39	0.51	.99

[a] Measurement made a short distance below intake before station was established.

NOTE.—Additional measurements made early in 1912 were used in determining the rating.

Daily gage height, in feet, of Kamenehune ditch near Waimea, Kauai, for 1911.

[T. Mokuahakea, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.61	.90	11	.41	.53	1.60	21	.50	1.43	.79
2	.....	.61	1.00	12	.65	.81	1.10	22	.50	1.42	.74
3	.....	.60	.81	13	.59	.76	1.18	23	.40	1.40	1.40
4	.....	.51	.89	14	.52	1.41	.81	24	.80	.61	1.15
5	.....	.60	.80	15	.60	1.20	1.50	25	1.20	1.62	.70
6	.....	.51	.80	16	.51	1.10	1.05	26	.71	1.45	.80
7	.....	.50	.80	17	.54	1.41	.90	27	.70	1.52	.80
8	.....	.50	1.10	18	.71	1.49	1.05	28	.70	1.40	.70
9	.51	.50	.90	19	.80	1.61	.80	29	.70	1.01	1.10
10	.42	.50	.89	20	.44	1.51	.80	30	.60	.90	.90
								31	.61	.....	.74

Daily discharge, in second-feet, of Kamenehune ditch near Waimea, Kauai, for 1911.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	1.2	2.0	11	.7	1.1	4.2	21	1.0	3.7	1.8
2	.....	1.2	2.3	12	1.4	1.8	2.7	22	1.0	3.6	1.6
3	.....	1.2	1.8	13	1.2	1.7	2.9	23	.7	3.6	3.6
4	.....	1.0	2.0	14	1.0	3.6	1.8	24	1.8	1.2	2.8
5	.....	1.2	1.8	15	1.2	3.0	3.9	25	3.0	4.2	1.5
6	.....	1.0	1.8	16	1.0	2.7	2.5	26	1.5	3.8	1.8
7	.....	1.0	1.8	17	1.1	3.6	2.0	27	1.5	3.9	1.8
8	.....	1.0	2.7	18	1.5	3.9	2.5	28	1.5	3.6	1.5
9	1.0	1.0	2.0	19	1.8	4.2	1.8	29	1.5	2.3	2.7
10	.7	1.0	2.0	20	.8	3.9	1.8	30	1.2	2.0	2.0
								31	1.2	.....	1.6

NOTE.—Daily discharge computed from a rating curve that is poorly defined. This diversion is above the gaging station on Waimea River.

Monthly discharge of Kamenehune ditch near Waimea, Kauai, for Oct. 9 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 9–31	3.0	0.7	1.27	57.9	C.
November	4.2	1.0	2.41	143	C.
December	4.2	1.5	2.23	137	C.

MAKAWELI RIVER BASIN.

GENERAL FEATURES.

Makaweli River drains a long narrow basin in private ownership, occupying the western slope of Waialeale and lying south of Waimea basin. It is about 12 miles long and 25 to 30 square miles in area. The upper part of the basin, where the rainfall is greatest, is nearly 4 miles wide, but the lower part is hardly more than a mile wide.

Makaweli River proper is only a few miles long. It is the product of three separate streams or branches, which are called Olokele, Kahana, and Makuone. The Olokele, the largest and most important, reaches back to the summits of Waialeale and Kawaikini, where the rainfall is probably as much as 400 inches a year. Its deep canyon extends far back into the mountain and is remarkably beautiful. The other two streams are farther northwest, rise at lower altitudes, and receive less rainfall. Their canyons are shorter and less accessible. Below the junction of its three branches the Makaweli runs through a canyon valley similar to the Waimea valley. Makaweli and Waimea rivers unite practically at sea level about a mile from the sea.

The principal diversion from Makaweli basin is Olokele ditch, which takes water from the south side of Olokele Stream at 1,477 feet elevation. Poowaiomahaihai ditch diverts water a short distance above the mouth of Makaweli River for irrigation on the east side of the valley below. Other small ditches divert water for taro and rice.

Gaging stations are maintained on Makaweli River near its mouth and on Olokele and Poowaiomahaihai ditches.

MAKAWELI RIVER NEAR WAIMEA, KAUAI.

A gaging station was established on Makaweli River about half a mile above its mouth and 2 miles from Waimea, October 6, 1911. The river at this point is straight and swift.

The equipment consists of a staff gage on the right bank, graduated in tenths of feet, and a wire suspension bridge 102 feet long. The banks are low and subject to overflow, but there is only one channel at all stages. The extreme range of stage is about 6 or 7 feet.

This station is below all diversions, and the discharge here represents the water going to sea through Makaweli River.

Discharge measurements of Makaweli River near Waimea, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 15	W. V. Hardy	63	116	4.12	110
Oct. 27	do	14	15.4	3.22	9.7

NOTE.—An additional measurement made early in 1912 was used in determining the rating. Measurements made by wading at various sections.

Daily gage height, in feet, of Makaweli River near Waimea, Kauai, for 1911.

[Taguchi Ametaro, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	3.28	3.30	16	.....	3.20	4.00	3.78
2	.....	.....	3.26	3.27	17	.....	3.28	4.78	3.50
3	.....	.....	3.27	3.28	18	.....	3.26	4.87	3.38
4	.....	.....	3.28	3.27	19	.....	3.12	4.50	3.32
5	.....	.....	3.26	3.20	20	.....	3.20	4.00	3.30
6	.....	3.35	3.40	4.00	21	.....	3.25	3.86	3.40
7	.....	3.40	3.30	3.52	22	.....	3.25	3.82	3.35
8	.....	3.32	3.28	5.00	23	.....	3.32	3.56	3.38
9	.....	3.33	3.40	5.60	24	.....	3.85	3.97	3.38
10	.....	3.32	3.50	3.60	25	.....	3.37	3.48	3.32
11	.....	3.22	4.50	4.00	26	.....	3.26	3.46	3.30
12	.....	3.25	3.40	3.50	27	.....	3.27	3.42	3.28
13	.....	3.30	3.46	3.32	28	.....	3.26	3.36	3.25
14	.....	3.22	3.57	3.50	29	.....	3.27	3.32	3.80
15	4.20	3.22	4.56	4.50	30	.....	3.22	3.30	3.30
					31	.....	3.26	.....	3.32

Daily discharge, in second-feet, of Makaweli River near Waimea, Kauai, for 1911.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	12	13	16	.....	8.2	86	54
2	.....	.....	11	12	17	.....	12	277	26
3	.....	.....	12	12	18	.....	11	303	18
4	.....	.....	12	12	19	.....	5.4	200	14
5	.....	.....	11	8.2	20	.....	8.2	86	13
6	.....	16	19	86	21	.....	11	64	19
7	.....	19	13	28	22	.....	11	59	16
8	.....	14	12	341	23	.....	14	31	18
9	.....	15	19	520	24	.....	63	81	18
10	.....	14	26	34	25	.....	17	25	14
11	.....	9.2	200	86	26	.....	11	23	13
12	.....	11	19	26	27	.....	12	20	12
13	.....	13	23	14	28	.....	11	17	11
14	.....	9.2	32	26	29	.....	12	14	56
15	125	9.2	216	200	30	.....	9.2	13	13
					31	.....	11	.....	14

NOTE.—Daily discharge computed from a rating curve fairly well defined below 120 second-feet. The table shows the amount of water passing into the sea below all diversions.

Monthly discharge of Makaweli River near Waimea, Kauai, for Oct. 6 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 6–31	63	5.4	13.7	707	B.
November	303	11	64.5	3,840	C.
December	520	8.2	56.4	3,470	C.

OLOKELE DITCH AT TUNNEL NO. 12, NEAR MAKAWELI, KAUAI.

Olokele ditch diverts water from the south side of Olokele Stream at elevation of 1,477 feet. The water is carried along the south side of Olokele Canyon through practically continuous tunnel for 5 or 6 miles, and then on to the upper cane fields of the plantation of the Hawaiian Sugar Co., at Makaweli.

The Hawaiian Sugar Co. keeps a daily gage-height record at a gage in an open masonry section of the ditch at tunnel No. 12, about 2 miles below the intake, and has furnished the records to the Geological Survey. These gage heights have been used to make an estimate of the flow at this point by means of a rating determined by a few measurements made at medium stages. The results, however, are probably very good.

Discharge measurements of Olokele ditch at tunnel No. 12, near Makaweli, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 16	Martin and Hoyt	.....	20.1	2.63	65

NOTE.—Additional measurements made early in 1912 were used in determining the rating.

Daily gage height, in feet, of Olokele ditch at tunnel No. 12, near Makaweli, Kauai, for 1910–11.

[Hawaiian Sugar Co., observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	2.0	2.8	2.5	3.5	2.4	3.3	2.8	2.8	2.4	3.5	2.4	3.4
2	2.0	2.5	2.5	3.5	3.5	3.5	3.1	2.5	2.3	2.9	1.0	3.3
3	2.0	2.8	2.6	3.5	2.5	3.5	3.1	2.9	3.5	2.9	1.0	2.9
4	2.0	2.5	3.5	2.8	3.5	2.6	3.5	3.2	3.4	2.5	1.0	2.4
5	2.0	2.5	3.3	3.4	2.9	3.5	3.1	3.5	3.4	2.6	1.5	2.4
6	2.0	2.4	3.0	2.5	2.9	3.0	2.7	3.5	2.7	2.4	1.5	2.4
7	2.0	2.3	3.5	3.4	3.5	2.6	2.6	3.0	2.4	2.5	1.5	3.1
8	2.0	2.3	2.5	3.3	2.7	3.5	2.5	2.6	2.5	3.5	1.5	2.4
9	2.0	2.3	2.3	2.6	2.9	3.5	2.4	2.7	2.5	3.1	1.3	2.9
10	2.5	2.5	2.3	2.4	2.7	3.4	2.4	2.7	2.4	3.2	2.0	2.5
11	2.0	2.6	2.2	2.4	2.5	2.6	2.4	2.5	2.4	2.6	1.5	2.3
12	2.0	3.2	2.2	2.4	2.5	3.5	3.5	2.6	2.4	3.5	1.5	2.3
13	2.0	2.4	2.2	2.7	2.4	3.5	3.5	2.4	2.6	3.5	2.5	2.2
14	1.5	2.4	2.2	2.3	2.4	3.5	2.7	3.1	2.6	3.2	2.0	2.2
15	2.0	2.3	2.2	2.3	2.3	3.5	2.8	2.5	2.5	2.6	2.4	2.2
16	2.0	2.3	2.2	2.3	3.5	3.5	2.5	2.6	2.8	2.7	2.3	2.1
17	2.0	2.2	2.2	3.5	2.8	3.5	2.4	2.4	2.5	2.4	2.3	2.1
18	2.0	2.2	2.1	3.0	2.6	3.5	2.3	2.5	2.4	2.4	2.3	2.1
19	2.0	2.2	2.4	3.0	2.0	2.6	2.6	2.7	2.3	2.3	2.6	2.1
20	2.0	2.2	3.5	3.5	3.1	3.5	3.5	2.4	2.8	2.4	2.4	2.1
21	2.0	2.2	3.7	3.3	2.9	3.5	2.8	3.5	2.9	2.4	2.3	2.1
22	2.0	2.2	3.1	2.8	2.5	3.5	2.7	3.0	2.9	2.8	2.3	2.1
23	2.0	2.6	3.5	2.0	2.4	2.8	2.6	2.5	2.4	3.5	2.6	3.5
24	3.0	2.3	3.5	3.5	2.4	3.0	3.0	2.4	3.3	2.9	2.8	3.5
25	3.5	2.2	3.5	3.5	2.3	3.0	2.6	3.5	3.2	2.4	3.5	3.5
26	3.0	2.3	3.5	3.5	2.3	3.0	2.7	3.5	3.0	2.3	3.5	2.9
27	2.6	2.0	3.4	3.0	2.3	2.7	3.5	2.7	3.5	3.5	3.3	3.5
28	3.0	2.5	3.5	3.5	2.2	2.7	3.5	3.0	3.5	3.5	2.5	3.1
29	2.8	.....	3.5	2.6	2.2	3.0	2.8	2.7	2.7	2.8	3.5	2.6
30	2.5	.....	3.4	2.5	3.4	3.2	2.6	2.5	2.7	2.6	3.0	3.5
31	2.5	.....	3.5	.....	3.3	.....	3.5	2.4	.....	3.5	.....	2.0
1911.												
1	2.0	1.5	1.5	2.7	2.6	3.4	3.0	2.4	2.9	3.5	2.4	2.4
2	2.0	1.5	1.5	2.6	2.6	3.5	3.5	2.5	2.4	2.9	2.4	2.4
3	2.3	1.5	2.4	2.6	2.6	3.0	3.5	3.5	2.4	2.8	2.4	2.4
4	2.3	1.5	3.0	2.6	3.0	3.3	3.5	2.5	2.4	3.5	2.3	2.6
5	2.3	1.5	2.7	2.5	3.0	3.5	3.5	2.4	2.9	3.3	3.5	2.5
6	3.2	2.0	2.6	2.5	2.8	3.5	3.5	2.4	3.5	2.7	2.9	3.5
7	2.5	2.0	2.8	2.5	2.6	3.5	3.0	2.3	3.5	3.5	2.9	2.9
8	1.5	2.0	2.6	2.5	3.2	3.5	2.8	2.5	2.8	3.1	2.4	3.5
9	1.0	2.0	1.5	2.5	3.5	3.0	2.6	2.5	3.5	2.6	3.1	3.5
10	1.0	3.0	2.0	2.5	2.8	2.9	3.5	3.2	3.5	2.6	3.5	3.5

Daily gage height, in feet, of Olokele ditch at tunnel No. 12, near Makaweli, Kauai, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
11	1.5	3.0	2.0	2.5	3.5	2.6	3.0	2.6	3.5	2.5	3.5	3.5
12	1.5	3.0	2.0	3.0	3.2	2.8	2.8	2.8	3.5	2.5	3.0	3.5
13	1.5	3.0	2.7	.2	2.6	3.5	2.6	2.7	3.0	2.4	3.5	3.5
14	1.5	2.5	2.6	.7	2.5	3.4	3.0	3.5	2.9	2.5	3.5	3.3
15	1.5	2.5	2.6	2.5	3.0	3.5	2.5	2.9	3.5	2.5	3.5	3.5
16	1.5	2.7	2.7	2.5	3.5	2.8	2.5	3.1	3.1	2.4	3.5	3.5
17	1.5	2.6	2.9	3.5	2.9	2.7	3.0	3.5	3.5	2.5	3.5	3.5
18	1.5	2.5	1.3	3.2	2.7	2.7	2.6	3.5	3.5	2.5	3.5	3.5
19	1.5	2.5	1.8	3.2	2.7	2.5	2.4	2.6	3.0	2.4	3.5	3.2
20	1.5	2.5	2.0	3.5	2.6	2.9	3.5	3.5	3.5	2.3	3.5	2.8
21	1.8	2.5	2.0	3.5	2.5	3.2	2.8	2.8	3.5	2.3	3.5	2.9
22	1.8	2.5	2.0	3.5	3.0	3.0	3.0	2.5	3.5	2.3	3.5	2.7
23	2.0	2.6	2.0	3.5	3.5	2.8	2.8	2.4	2.0	2.3	3.0	2.8
24	2.0	3.0	2.0	3.0	2.9	3.3	2.6	2.9	2.0	2.4	3.0	2.6
25	1.5	3.4	2.0	3.0	2.5	3.5	2.5	2.5	2.0	3.5	2.7	2.5
26	1.5	1.5	2.0	3.1	2.5	3.2	2.4	2.5	2.0	2.5	2.8	2.5
27	1.5	1.5	2.0	3.5	3.5	3.5	2.5	3.5	3.0	2.4	2.7	2.4
28	1.5	1.5	2.0	3.5	3.5	3.5	3.5	2.5	3.1	2.4	2.6	2.4
29	1.5	.....	2.7	3.2	3.5	2.9	3.0	2.3	3.1	2.4	2.5	3.5
30	1.5	.....	2.8	2.8	3.4	3.5	2.5	2.7	3.5	2.4	2.4	2.9
31	1.5	.....	2.9	.....	3.5	.....	2.4	2.6	.....	2.5	.....	2.4

Daily discharge, in second-feet, of Olokele ditch at tunnel No. 12, near Makaweli, Kauai, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	43	72	60	100	56	92	72	72	56	100	56	96
2	43	60	60	100	100	100	84	60	52	76	15	92
3	43	72	64	100	60	100	84	76	100	76	15	76
4	43	60	100	72	100	64	100	88	96	60	15	56
5	43	60	92	96	76	100	84	100	96	64	28	56
6	43	56	80	60	76	80	68	100	68	56	28	56
7	43	52	100	96	100	64	64	80	56	60	28	84
8	43	52	60	92	68	100	60	64	60	100	28	56
9	43	52	52	64	76	100	56	68	60	84	22	76
10	60	60	52	56	68	96	56	68	56	88	43	60
11	43	64	49	56	60	64	56	60	56	64	28	52
12	43	88	49	56	60	100	100	64	56	100	28	52
13	43	56	49	68	56	100	100	56	64	100	60	49
14	28	56	49	52	56	100	68	84	64	88	43	49
15	43	52	49	52	52	100	72	60	60	64	56	49
16	43	52	49	52	100	100	60	64	72	68	52	46
17	43	49	49	100	72	100	56	56	60	56	52	46
18	43	49	46	80	64	100	52	60	56	56	52	46
19	43	49	56	80	43	64	64	68	52	52	64	46
20	43	49	100	100	84	100	100	56	72	56	56	46
21	43	49	108	92	76	100	72	100	76	56	52	46
22	43	49	84	72	60	100	68	80	76	72	52	46
23	43	64	100	43	56	72	64	60	56	100	64	100
24	80	52	100	100	56	80	80	56	92	76	72	100
25	100	49	100	100	52	80	64	100	88	56	100	100
26	80	52	100	100	52	80	68	100	80	52	100	76
27	64	43	96	80	52	68	100	68	100	100	92	100
28	80	60	100	100	49	68	100	80	100	100	60	84
29	72	.....	100	64	49	80	72	68	68	72	100	64
30	60	.....	96	60	96	88	64	60	68	64	80	100
31	60	.....	100	.....	92	.....	100	56	.....	100	.....	43

Daily discharge, in second-feet, of Olokele ditch at tunnel No. 12, near Makaweli, Kauai, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	43	28	28	68	64	96	80	56	76	100	56	56
2	43	28	28	64	64	100	100	60	56	76	56	56
3	52	28	56	64	64	80	100	100	56	72	56	56
4	52	28	80	64	80	92	100	60	56	100	52	64
5	52	28	68	60	80	100	100	56	76	92	100	60
6	88	43	64	60	72	100	100	56	100	68	76	100
7	60	43	72	60	64	100	80	52	100	100	76	76
8	28	43	64	60	88	100	72	60	72	84	56	100
9	15	43	28	60	100	80	64	60	100	64	84	100
10	15	80	43	60	72	76	100	88	100	64	100	100
11	28	80	43	60	100	64	80	64	100	60	100	100
12	28	80	43	80	88	72	72	72	100	60	80	100
13	28	80	68	2.1	64	100	64	68	80	56	100	100
14	28	60	64	9.4	60	96	80	100	76	60	100	92
15	28	60	64	60	80	100	60	76	100	60	100	100
16	28	68	68	60	100	72	60	84	84	56	100	100
17	28	64	76	100	76	68	80	100	100	60	100	100
18	28	60	22	88	68	68	64	100	100	60	100	100
19	28	60	37	88	68	60	56	64	80	56	100	88
20	28	60	43	100	64	76	100	100	100	52	100	72
21	37	60	43	100	60	88	72	72	100	52	100	76
22	37	60	43	100	80	80	80	60	100	52	100	68
23	43	64	43	100	100	72	72	56	43	52	80	72
24	43	80	43	80	76	72	64	76	43	56	80	64
25	28	96	43	80	60	100	60	60	43	100	68	60
26	28	28	43	84	60	88	56	60	43	60	72	60
27	28	28	43	100	100	100	60	100	80	56	68	56
28	28	28	43	100	100	100	100	60	84	56	64	56
29	28	.....	68	88	100	76	80	52	84	56	60	100
30	28	.....	72	72	96	100	60	68	100	56	56	76
31	28	.....	76	.....	100	.....	56	64	.....	60	.....	56

NOTE.—Daily discharge computed from a rating curve that is poorly defined.

Monthly discharge of Olokele ditch at tunnel No. 12, near Makaweli, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
January	100	43	51.2	3,150	C.
February	88	43	56.4	3,130	C.
March	108	46	75.8	4,660	C.
April	100	43	78.1	4,650	C.
May	100	43	68.3	4,200	C.
June	100	64	88.0	5,240	C.
July	100	52	74.5	4,580	C.
August	100	56	72.0	4,430	C.
September	100	52	70.5	4,200	C.
October	100	52	74.7	4,590	C.
November	100	15	51.4	3,060	C.
December	100	43	66.1	4,060	C.
The year	108	15	69.0	50,000	
1911.					
January	88	15	35.0	2,150	D.
February	96	28	53.9	2,990	C.
March	80	28	52.2	3,210	C.
April	100	2.1	72.4	4,310	C.
May	100	60	79.0	4,860	C.
June	100	60	86.5	5,150	C.
July	100	56	76.5	4,700	C.
August	100	52	71.1	4,370	C.
September	100	43	81.1	4,830	D.
October	100	52	66.3	4,080	C.
November	100	52	81.3	4,840	D.
December	100	56	79.5	4,890	D.
The year	100	2.1	69.6	50,400	

POOWAIOMAHAIHAI DITCH NEAR WAIMEA, KAUAI.

Poowaiomahaihai ditch diverts water from the east bank of Makaweli River only a short distance above the gaging station on the river. It is probably an ancient auwai, or old taro ditch, but is now used for irrigating cane on the east side of lower Waimea River.

A gaging station was established on this ditch 250 feet below the intake October 27, 1911. A staff gage graduated in tenths of feet and a board footbridge for use in making measurements constitute the equipment.

Discharge measurements of Poowaiomahaihai ditch near Waimea, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 27	W. V. Hardy	9.5	3.39	0.99	5.1

NOTE.—Additional measurements made early in 1912 were used in determining the rating.

Daily gage height, in feet, of Poowaiomahaihai ditch near Waimea, Kauai, for 1911.

[Taguchi Ametaro, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	1.0	1.1	11	.....	1.1	1.5	21	.....	1.05	1.2
2	.....	1.0	1.1	12	.....	1.0	1.3	22	.....	1.0	1.1
3	.....	1.0	1.1	13	.....	1.0	1.2	23	.....	1.0	1.2
4	.....	1.0	1.1	14	.....	1.05	1.7	24	.....	1.0	1.2
5	.....	1.0	1.1	15	.....	1.1	1.9	25	.....	1.0	1.15
6	.....	1.0	1.5	16	.....	1.05	1.5	26	.....	1.0	1.15
7	.....	1.0	1.2	17	.....	1.1	1.3	27	1.0	1.1	1.1
8	.....	1.0	1.7	18	.....	1.1	1.2	28	1.0	1.1	1.1
9	.....	1.0	1.0	19	.....	1.05	1.1	29	1.0	1.1	1.3
10	.....	1.05	1.4	20	.....	1.05	1.1	30	1.0	1.1	1.1
								31	1.0	.....	1.15

Daily discharge, in second-feet, of Poowaiomahaihai ditch near Waimea, Kauai, for 1911.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	5.4	8.4	11	.....	8.4	29	21	.....	6.8	13
2	.....	5.4	8.4	12	.....	5.4	18	22	.....	5.4	8.4
3	.....	5.4	8.4	13	.....	5.4	13	23	.....	5.4	13
4	.....	5.4	8.4	14	.....	6.8	39	24	.....	5.4	13
5	.....	5.4	8.4	15	.....	8.4	49	25	.....	5.4	10
6	.....	5.4	29	16	.....	6.8	29	26	.....	5.4	10
7	.....	5.4	13	17	.....	8.4	18	27	5.4	8.4	8.4
8	.....	5.4	39	18	.....	8.4	13	28	5.4	8.4	8.4
9	.....	5.4	5.4	19	.....	6.8	8.4	29	5.4	8.4	18
10	.....	6.8	23	20	.....	6.8	8.4	30	5.4	8.4	8.4
								31	5.4	.....	10

NOTE.—Daily discharge computed from a rating curve that is poorly defined. The table shows the amount of water taken from Makaweli River just above the station on the river.

Monthly discharge of Poowaiomahaihai ditch near Waimea, Kauai, for Oct. 27 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 27–31	5.4	5.4	5.40	53.6	C.
November	8.4	5.4	6.48	386	C.
December	49	5.4	16.0	984	D.

HANAPEPE RIVER BASIN.

GENERAL FEATURES.

Hanapepe River drains a long narrow basin in Government ownership reaching from Hanapepe Bay to Kawaikini, the highest point of the island. The upper part of the basin lies east of Olokele basin and west of the main divide which separates it from South Wailua basin on the east. The principal water-producing area of Hanapepe basin, however, lies north of Manuahi Stream, which is tributary to the Hanapepe from the west at Koula. This upper area is diamond-shaped, its width being 2½ miles and its length 4½ miles. The main stream follows the long diagonal southward. Below Hanapepe Falls, which are about 8 miles above the mouth and 5 miles below the source, the course of the stream is through a deep canyon for several miles. Farther down, however, the canyon decreases in depth and increases in bottom width, thus forming Hanapepe Gulch and valley.

Hanapepe River is formed by two principal branches which unite just below Hanapepe Falls (Manawaiopuna, as called by the natives). The west branch is considerably the larger, and is called Hiloa Stream. The east branch seems to have no special name among the natives, but in this report it has been designated Hanapepe Stream on account of Hanapepe Falls, which are formed by it. The lower main fall is about 360 feet high, and is the highest and most beautiful waterfall on the island.

The rainfall in the upper Hanapepe basin is very heavy. A rain gage placed August 24, 1910, on the Hiloa-Hanapepe Ridge at elevation of 2,080 feet, registered 74 inches to the end of 1910 and 249 inches during 1911, or an average of 0.65 inch a day for the whole period.

Water for cane irrigation is diverted from Hanapepe River and tributaries at elevation of 520 feet through Hanapepe ditch. Numerous other small ditches take out water for rice and taro irrigation in the valley between Koula and the sea, a distance of 5 or 6 miles,

Gaging stations have been placed on the Hanapepe and Hiloa streams at the ditch intakes just below the falls, and on the main stream at Koula, also on Hanapepe and Hiloa ditches near the intakes and on the main ditch below the siphon at Koula.

HANAPEPE RIVER AT HANAPEPE FALLS, NEAR ELEELE, KAUAI.

A gaging station was established on Hanapepe River November 22, 1911, at the intake of the ditch which heads in the pool at the foot of Hanapepe Falls.

The gage is graduated in tenths of feet and is bolted to the stone abutment on the west side of the ditch, so that its zero is about level with the crest of the dam. The dam is 75 feet long, 3 feet wide at the crest, and about 4 feet high. The crest of the dam is smooth and measurements are made on the crest by wading. To the flow over the dam must be added the flow in the ditch in order to get the total quantity passing over Hanapepe Falls.

Discharge measurements of Hanapepe River at Hanapepe Falls, near Eleele, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 22[a]	W. V. Hardy	70	11.8	0.24	11.4

[a] Measurement made by wading on crest of dam. The zero of the gage is about one-tenth of a foot below the average level of the crest.

Daily gage height, in feet, of Hanapepe River at Hanapepe Falls, near Eleele, Kauai, for 1911.

[S. W. Holmer, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.0	11		.8	21		.0
2		.0	12		.3	22	0.2	.0
3		.0	13		.1	23	.2	.0
4		.0	14		.2	24	.2	.0
5		.0	15		.2	25	.2	.0
6		.5	16		.3	26	.0	.0
7		.2	17		.0	27	.0	.0
8		.65	18		.0	28	.0	.0
9		.0	19		.3	29	.0	.0
10		.0	20		.1	30	.0	.0
						31		.0

Daily discharge, in second-feet, of Hanapepe River at Hanapepe Falls, near Eleele, Kauai, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.0	11		119	21		0.0
2		.0	12		19	22	7.0	.0
3		.0	13		.4	23	7.0	.0
4		.0	14		7.0	24	7.0	.0
5		.0	15		7.0	25	7.0	.0
6		52	16		19	26	.0	.0
7		7.0	17		.0	27	.0	.0
8		83	18		.0	28	.0	.0
9		.0	19		19	29	.0	.0
10		.0	20		.4	30	.0	.0
						31		.0

NOTE.—Daily discharge determined by one measurement on the crest of the dam, which is 3 feet wide and 75 feet long, and a curve for a broad-crested weir. The table shows the amount of water passing over Hanapepe Falls and not taken by Hanapepe ditch.

HANAPEPE RIVER AT KOULA, NEAR ELEELE, KAUAI.

A gaging station was established on Hanapepe River at Koula August 18, 1910. This station is at the second ford about half a mile above the siphon at Koula.

The equipment consists of an inclined staff gage and Friez clock register for obtaining gage heights, with a cable and car for use in making high-water measurements. Low-water measurements must be made by wading on account of the sluggish current under the cable which is intended for use in only high or moderate stages.

The bottom of the stream consists of bowlders above and below the station, but the section seems to be permanent. There is, however, some probability of change at the ford below the station which may affect the section above.

The stream is about 40 feet wide at low water, and its maximum range of stage is 6 to 8 feet.

The flow at this point is exclusive of the amount taken by Hanapepe ditch 2 or 3 miles above. To obtain total discharge of river add flow of ditch at Koula.

Discharge measurements of Hanapepe River at Koula, near Eleele, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 18[a]	Martin and Schnack	35.1	30.4	1.02	14.8
Sept. 29[b]	Martin and Pierce	53	234	1.77	78
1911.					
Feb. 17[b]	Martin and Hoyt	58	252	1.82	93
May 1[a]	W. F. Martin	39.8	83	1.27	22.8
Nov. 23[a]	W. V. Hardy	58	58	1.38	42.3

[a] Measurement made by wading below the cable.
[b] Measurement made from cable.

NOTE.—An additional measurement made early in 1912 was used in determining the rating.

Daily gage height, in feet, of Hanapepe River at Koula, near Eleele, Kauai, for 1910–11.

[S. W. Holmer, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.						1910.					
1	.....	1.1	1.35	2.20	1.2	16	1.0	1.35	1.3	1.15	1.0
2	.....	1.1	1.2	3.6	1.15	17	1.1	1.15	1.2	1.25	1.0
3	.....	1.15	1.2	2.35	1.1	18	1.1	1.1	1.15	1.3	1.0
4	.....	1.4	1.3	2.45	1.1	19	1.05	1.2	1.3	1.35	1.0
5	.....	1.1	1.15	2.4	1.05	20	2.35	1.15	1.15	1.2	1.0
6	.....	1.1	1.1	1.95	1.05	21	2.2	1.9	1.1	1.2	1.0
7	.....	1.1	1.15	2.0	1.0	22	1.5	1.7	1.15	1.2	1.05
8	.....	1.1	1.8	1.95	1.0	23	1.2	1.6	1.45	1.4	1.6
9	.....	1.2	1.5	1.9	1.1	24	1.15	1.6	1.15	1.3	3.35
10	.....	1.1	1.3	2.55	1.0	25	2.4	1.6	1.1	1.55	4.10
31	.....	1.05	1.15	2.6	1.0	26	1.65	1.5	1.15	2.2	3.65
12	.....	1.45	2.30	2.0	1.0	27	1.7	1.5	2.50	1.8	2.3
13	.....	1.5	3.0	1.7	1.0	28	1.4	2.0	2.90	1.2	1.7
14	.....	1.15	2.0	1.3	1.0	29	1.35	1.5	1.7	1.3	1.8
15	.....	1.75	1.5	1.2	1.0	30	1.15	1.55	1.4	1.2	2.70
						31	1.1	.....	1.25	.....	2.05

Daily gage height, in feet, of Hanapepe River at Koula, near Eleele, Kauai, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.95	3.9	1.8	1.6	1.3	1.9	1.65	1.2	1.2	1.9	1.0	1.1
2	1.7	2.9	1.8	1.6	1.2	2.1	1.6	1.15	1.1	1.6	1.0	1.1
3	1.2	2.4	1.75	1.55	1.3	2.15	1.6	1.5	1.1	1.95	1.0	1.1
4	1.2	2.4	1.65	1.5	1.25	1.95	2.05	1.15	1.1	2.2	1.0	1.1
5	1.25	2.15	1.6	1.5	1.25	1.6	1.6	1.1	1.3	1.7	1.3	1.1
6	1.25	3.05	1.6	1.5	1.15	2.05	2.05	1.1	1.5	1.6	1.15	1.95
7	1.8	2.6	1.7	1.45	1.2	2.4	1.5	1.15	1.3	1.6	1.15	1.35
8	2.65	2.3	2.3	1.45	1.2	2.1	1.4	1.2	1.1	1.5	1.3	1.5
9	2.3	2.45	1.95	1.4	1.3	1.6	1.35	1.1	1.5	1.35	1.55	4.0
10	3.1	3.1	1.85	1.4	1.1	1.45	1.8	1.4	2.1	1.3	1.5	2.0
11	3.3	2.6	1.8	1.3	1.2	1.5	1.55	1.1	2.4	1.2	1.4	2.5
12	4.15	2.5	1.75	1.4	1.2	1.35	1.45	2.1	2.5	1.2	1.15	2.1
13	3.5	2.15	1.55	1.6	1.1	2.4	1.35	1.5	1.5	1.2	1.95	1.8
14	2.5	2.05	1.5	1.5	1.1	2.15	1.4	1.7	1.45	1.15	2.1	1.75
15	2.1	1.95	1.5	1.25	1.3	1.85	1.25	1.4	2.2	1.15	2.2	1.3
16	2.0	1.9	1.6	1.2	1.55	1.5	1.2	1.3	1.6	1.15	1.7	2.5
17	3.65	1.9	1.65	1.8	1.4	1.5	1.35	1.65	2.6	1.15	2.2	1.7
18	2.4	1.6	1.7	1.7	1.25	1.35	1.2	1.7	2.6	1.1	2.35	1.8
19	2.6	1.35	1.8	2.05	1.15	1.35	1.35	1.8	1.7	1.1	2.3	1.65
20	2.1	1.35	1.7	2.05	1.2	1.4	1.55	1.95	2.45	1.1	1.75	1.5
21	1.95	1.5	1.65	3.0	2.05	2.4	1.65	1.4	3.4	1.1	1.75	1.4
22	1.95	1.6	1.55	2.2	1.7	1.7	1.4	1.2	3.4	1.05	1.55	1.35
23	1.9	1.7	1.6	2.5	2.0	1.9	1.3	1.15	2.6	1.1	1.35	1.2
24	3.15	2.0	1.55	2.15	1.35	1.7	1.2	1.15	4.8	1.3	1.3	1.2
25	3.15	1.8	2.65	1.65	1.15	2.1	1.15	1.1	2.6	1.0	1.45	1.15
26	2.35	2.7	2.5	1.45	1.1	2.2	1.1	1.25	3.2	1.0	1.3	1.1
27	2.65	1.95	2.05	2.4	1.3	1.9	2.4	1.4	2.5	1.0	1.75	1.1
28	4.05	1.8	1.95	2.0	2.2	1.95	2.4	1.1	2.0	1.0	1.1	1.1
29	2.45	.....	1.9	1.6	2.5	2.1	1.8	1.1	1.7	1.0	1.1	1.4
30	2.20	.....	1.75	1.4	2.2	2.0	1.4	1.3	1.9	1.05	1.1	1.4
31	3.35	.....	1.65	.....	2.3	.....	1.25	1.5	.....	1.05	.....	1.1

Daily discharge, in second-feet, of Hanapepe River at Koula, near Eleele, Kauai, for 1910–11.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.						1910.					
1	.....	18	34	160	24	16	14	34	30	21	14
2	.....	18	24	452	21	17	18	21	24	27	14
3	.....	21	24	190	18	18	18	18	21	30	14
4	.....	38	30	210	18	19	16	24	30	34	14
5	.....	18	21	200	16	20	190	21	21	24	14
6	.....	18	18	111	16	21	160	102	18	24	14
7	.....	18	21	120	14	22	48	72	21	24	16
8	.....	18	86	111	14	23	24	60	43	38	60
9	.....	24	48	102	18	24	21	60	21	30	397
10	.....	18	30	230	14	25	200	60	18	54	563
11	.....	16	21	240	14	26	66	48	21	160	463
12	.....	43	180	120	14	27	72	48	220	86	180
13	.....	48	320	72	14	28	38	120	300	24	72
14	.....	21	120	30	14	29	34	48	72	30	86
15	.....	79	48	24	14	30	21	54	38	24	260
						31	18	.....	27	.....	130

Daily discharge, in second-feet, of Hanapepe River near Eleele, Kauai, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	111	518	86	60	30	102	66	24	24	102	14	18
2	72	300	86	60	24	140	60	21	18	60	14	18
3	24	200	79	54	30	150	60	48	18	111	14	18
4	24	200	66	48	27	111	130	21	18	160	14	18
5	27	150	60	48	27	60	60	18	30	72	30	18
6	27	331	60	48	21	130	130	18	48	60	21	111
7	86	240	72	43	24	200	48	21	30	60	21	34
8	250	180	180	43	24	140	38	24	18	48	30	48
9	180	210	111	38	30	60	34	18	48	34	54	540
10	342	342	94	38	18	43	86	38	140	30	48	120
11	386	240	86	30	24	48	54	18	200	24	38	220
12	574	220	79	38	24	34	43	140	220	24	21	140
13	430	150	54	60	18	200	34	48	48	24	111	86
14	220	130	48	48	18	150	38	72	43	21	140	79
15	140	111	48	27	30	94	27	38	160	21	160	30
16	120	102	60	24	54	48	24	30	60	21	72	220
17	463	102	66	86	38	48	34	66	240	21	160	72
18	200	60	72	72	27	34	24	72	240	18	190	86
19	240	34	86	130	21	34	34	86	72	18	180	66
20	140	34	72	130	24	38	54	111	210	18	79	48
21	111	48	66	320	130	200	66	38	408	18	79	38
22	111	60	54	160	72	72	38	24	408	16	54	34
23	102	72	60	220	120	102	30	21	240	18	34	24
24	353	120	54	150	34	72	24	21	724	30	30	24
25	353	86	250	66	21	140	21	18	240	14	43	21
26	190	260	220	43	18	160	18	27	364	14	30	18
27	250	111	130	200	30	102	200	38	220	14	79	18
28	552	86	111	120	160	111	200	18	120	14	18	18
29	210	.....	102	60	220	140	86	18	72	14	18	38
30	160	.....	79	38	160	120	38	30	102	16	18	38
31	397	.....	66	.....	180	.....	27	48	.....	16	.....	18

NOTE.—Daily discharge computed from a rating curve fairly well defined below 100 second-feet. The table does not include the water in Hanapepe ditch.

Monthly discharge of Hanapepe River at Koula, near Eleele, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
August 16–31	200	14	59.8	1,900	B.
September	120	16	40.2	2,390	B.
October	320	18	62.9	3,870	C.
November	452	21	100	5,950	C.
December	560	14	82.0	5,040	C.
1911.					
January	574	24	221	13,600	D.
February	518	34	168	9,330	C.
March	247	48	88.8	5,460	C.
April	320	24	83.5	4,970	C.
May	218	18	54.1	3,330	B.
June	203	34	103	6,130	C.
July	201	18	58.8	3,620	B.
August	141	18	39.8	2,450	B.
September	725	18	158	9,400	C.
October	160	14	36.5	2,240	B.
November	186	14	60.5	3,600	B.
December	540	18	73.5	4,520	C.
The year	725	14	94.8	68,600	

NOTE.—The above estimate does not include the water in Hanapepe ditch.

HANAPEPE DITCH AT HANAPEPE FALLS, NEAR ELEELE, KAUAI.

Hanapepe ditch takes water from the west side of Hanapepe Stream at the foot of Hanapepe Falls (elevation, 520 feet), and unites with Hiloa ditch about 600 feet below. It takes all the low-water flow of Hanapepe Stream.

A gaging station was established on this ditch November 22, 1911. The gage is in a flume about 400 feet below the intake, and is graduated in tenths of feet. Measurements are made from a cross timber of the flume about 4 feet above the gage.

Discharge measurements of Hanapepe ditch at Hanapepe Falls, near Eleele, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 22	W. V. Hardy	5.2	5.9	1.15	17.5

NOTE.—Additional measurements made early in 1912 were used in determining the rating.

Daily gage height, in feet, of Hanapepe ditch at Hanapepe Falls, near Eleele, Kauai, for 1911.

[S. W. Holmer, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		1.05	11		1.6	21		1.25
2		1.05	12		1.4	22	1.2	1.25
3			13		1.35	23	1.2	1.25
4		1.1	14		1.35	24	1.25	
5		1.05	15		1.4	25	1.2	
6		1.45	16		1.4	26		1.15
7		1.2	17			27	1.15	1.1
8		1.35	18			28	1.1	1.1
9			19		1.4	29	1.1	1.15
10			20		1.3	30	1.1	1.2
						31		1.1

Daily discharge, in second-feet, of Hanapepe ditch at Hanapepe Falls, near Eleele, Kauai, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		15	11		28	21		20
2		15	12		23	22	19	20
3		a 16	13		22	23	19	20
4		16	14		22	24	20	a 19
5		15	15		23	25	19	a 19
6		24	16		23	26	a 18	18
7		19	17		a 23	27	18	16
8		22	18		a 23	28	16	16
9		a 24	19		23	29	16	18
10		a 26	20		21	30	16	19
						31		16

a Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve that is poorly defined. It shows the quantity of water diverted at the foot of Hanapepe Falls.

Monthly discharge of Hanapepe ditch at Hanapepe Falls, near Eleele, Kauai, for Nov. 22 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 22-30	20	16	17.9	320	C.
December	28	15	20.1	1,240	D.

HANAPEPE DITCH AT KOULA, NEAR ELEELE, KAUAI.

Hanapepe ditch takes water from the west side of the two branch streams at Hanapepe Falls, and from small tributaries on both sides farther down. It consists mainly of wooden flume and pipe siphon inside the canyon, and crosses the stream four times before emerging upon the cane fields of the Hawaiian Sugar Co. on the west side of the river. The ditch is on the west side of the river in the upper canyon above Koula, and on the east side below.

The Hawaiian Sugar Co. maintains a gage in the first flume below the big siphon at Koula and has furnished the records to the Geological Survey for 1910 and 1911. The Survey has rated the section and has used the gage heights to obtain the daily flow.

This station is about 4 miles below the intake, and shows the amount of water taken from the river above the station at Koula.

Discharge measurements of Hanapepe ditch at Koula, near Eleele, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Inches.*	*Sec.-ft.*
Aug. 19	Martin and Schnack	4.95	14.3	34.5	45.0
Sept. 29	Martin and Pierce	4.9	15.3	37.7	52
1911.					
May 2	W. F. Martin	5.05	16.0	38.2	53.8

NOTE.—An additional measurement made early in 1912 was used in determining the rating.

Daily gage height, in inches, of Hanapepe ditch at Koula, near Hanapepe, Kauai, for 1910–11.

[Hawaiian Sugar Co.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	.....	18.5	37	37	37	37	37	37	35	37	35	36.8
2	.....	18.5	33	37	37	37	37	36	33.5	37	37	33.5
3	.....	18.5	36.5	37	37	37	37	36	35	37	37	33.5
4	.....	18.5	37	37	37	37	37	37	37	35	37	33
5	.....	18.5	37	37	37	37	37	37	35	35	37	33
6	.....	18.5	37	37	37	37	37	37	36	35	37	34
7	.....	18.5	34	37	37	37	37	37	34.5	33.2	37	34
8	.....	18.5	34	37	37	37	37	37	33	37	0	33.2
9	.....	18.5	31.5	36.5	37	37	37	37	37	37	0	36
10	.....	18.5	30	36	37	37	37	37	33.2	37	0	33
11	.....	18.5	29	34.5	37	37	37	37	34	35	0	32
12	.....	18.5	29	34.5	36	37	37	37	34	33	0	32
13	.....	18.5	29	35	34	37	37	35.5	37	37	35	31.5
14	.....	18.5	28.5	33.5	35	37	37	35.5	37	37	35	31
15	.....	31	28	0	34.5	37	37	35.5	36	37	35	30.5
16	.....	30.5	28	0	37	37	36.5	35.5	37	37	35	30.2
17	.....	30	28	0	37	37	36.5	35	37	37	32	30
18	.....	30	28	37	37	37	36.5	35	34.5	35.5	30	30
19	.....	30	32	37	37	37	37	34.5	32	35	30	29.8
20	.....	30	37	37	37	37	37	35	32	35	30	29.5
21	.....	29.5	37	37	37	37	37	37	37	34	30	29.2
22	.....	29	37	37	37	37	37	37	37	35	30	29
23	.....	33	37	37	37	37	37	37	37	37	30	37
24	.....	31	37	37	36	37	37	37	37	36	30	37
25	37	30	37	37	36.5	37	37	37	37	33.2	30	37
26	37	29	37	37	35	37	37	37	37	33.8	0	37
27	18	30	37	37	35	37	37	37	37	33	0	37
28	18	32	37	37	34	37	37	37	37	37	36	37
29	18	.....	37	37	35	37	37	37	37	37	37	37
30	17	.....	37	37	36.5	37	37	37	37	37	35.5	37
31	18	.....	37	.....	37	.....	37	37	.....	37	.....	0
1911.												
1	0	8.5	0	10	37	37	37	36	37	37	34	33
2	0	8.5	0	10	37	37	0	37	34.5	37	34	33
3	33	8.5	10	19	37	37	37	36	33.5	37	32	33
4	.....	8.5	19	19	37	0	0	36	33	37	33	34
5	32	8.5	19	19	37	37	37	35.5	36	37	35.5	34
6	33	8.5	19	19	37	37	37	0	37	37	35	37
7	33	0	19	19	37	37	37	35	37	37	37	37
8	0	0	19	19	37	37	37	36.2	34.5	37	36	37
9	0	0	10	19	37	37	37	35	37	35.8	37	37
10	0	0	0	19	37	37	37	37	37	37	37	37
11	18	0	0	20	37	0	37	37	37	37	37	37
12	18	0	19	28	37	37	37	37	37	37	37	37
13	18	0	19	28	37	37	37	37	37	37	36.5	37
14	18	8.5	19	28	36	37	37	37	37	37	37	37
15	18	8.5	19	33	36	37	37	37	37	36.5	37	37
16	18	8.5	19	33	37	37	37	37	37	36	37	37
17	10	7.8	19	36	37	9	37	37	37	37	37	37
18	0	7.8	0	37	37	9	37	37	37	37	37	37
19	0	7.8	0	37	36	37	37	37	0	36.5	37	37
20	0	37	0	37	37	37	37	37	37	36.2	37	37
21	8.5	18.5	0	37	37	37	37	37	37	36	37	37
22	8.5	18.5	0	37	37	37	37	37	37	35.8	37	37
23	8.5	19	19	0	37	37	0	36.8	37	35.5	37	37
24	8.5	0	0	36	36	37	36.5	36	0	35	36.2	37
25	8.5	0	0	37	37	0	36	35	0	36.5	36	0
26	8.5	0	10	37	36.8	37	35.5	36.5	0	36	36	35
27	8.5	0	10	37	9	37	37	37	37	35	36	35
28	8.5	0	10	37	9	37	37	36.8	36	34.5	35.8	34.5
29	8.5	.....	10	37	37	37	8	36	31	34.2	34.5	37
30	0	.....	10	0	37	37	37	36.5	.....	34	34	0
31	0	.....	10	.....	37	.....	37	37	.....	34	.....	37

Daily discharge, in second-feet, of Hanapepe ditch at Koula, near Hanapepe, Kauai, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	.....	18	51	51	51	51	51	51	47	51	47	51
2	.....	18	43	51	51	51	51	49	44	51	51	44
3	.....	18	50	51	51	51	51	49	47	51	51	44
4	.....	18	51	51	51	51	51	51	51	47	51	43
5	.....	18	51	51	51	51	51	51	47	47	51	43
6	.....	18	51	51	51	51	51	51	49	47	51	45
7	.....	18	45	51	51	51	51	51	46	43	51	45
8	.....	18	45	51	51	51	51	51	43	51	0	43
9	.....	18	41	50	51	51	51	51	51	51	0	49
10	.....	18	38	49	51	51	51	51	43	51	0	43
11	.....	18	36	46	51	51	51	51	45	47	0	42
12	.....	18	36	46	49	51	51	51	45	43	0	42
13	.....	18	36	47	45	51	51	48	51	51	47	41
14	.....	18	35	44	47	51	51	48	51	51	47	40
15	.....	40	34	0	46	51	51	48	49	51	47	39
16	.....	39	34	0	51	51	50	48	51	51	47	38
17	.....	38	34	0	51	51	50	47	51	51	42	38
18	.....	38	34	51	51	51	50	47	46	48	38	38
19	.....	38	42	51	51	51	51	46	42	47	38	38
20	.....	38	51	51	51	51	51	47	42	47	38	37
21	.....	37	51	51	51	51	51	51	51	45	38	36
22	.....	36	51	51	51	51	51	51	51	47	38	36
23	.....	43	51	51	51	51	51	51	51	51	38	51
24	.....	40	51	51	49	51	51	51	51	49	38	51
25	51	38	51	51	50	51	51	51	51	43	38	51
26	51	36	51	51	47	51	51	51	51	45	0	51
27	18	38	51	51	47	51	51	51	51	43	0	51
28	18	42	51	51	45	51	51	51	51	51	49	51
29	18	.....	51	51	47	51	51	51	51	51	51	51
30	16	.....	51	51	50	51	51	51	51	51	48	51
31	18	.....	51	.....	51	.....	51	51	.....	51	.....	0
1911.												
1	0	5.4	0	6.8	51	51	51	49	51	51	45	43
2	0	5.4	0	6.8	51	51	0	51	46	51	45	43
3	43	5.4	6.8	19	51	51	51	49	44	51	42	43
4	42	5.4	19	19	51	0	0	49	43	51	43	45
5	42	5.4	19	19	51	51	51	48	49	51	48	45
6	43	5.4	19	19	51	51	51	0	51	51	47	51
7	43	0	19	19	51	51	51	47	51	51	51	51
8	0	0	19	19	51	51	51	49	46	51	49	51
9	0	0	6.8	19	51	51	51	47	51	49	51	51
10	0	0	0	19	51	51	51	51	51	51	51	51
11	18	0	0	21	51	0	51	51	51	51	51	51
12	18	0	19	34	51	51	51	51	51	51	51	51
13	18	0	19	34	51	51	51	51	51	51	50	51
14	18	5.4	19	34	49	51	51	51	51	51	51	51
15	18	5.4	19	43	49	51	51	51	51	50	51	51
16	18	5.4	19	43	51	51	51	51	51	49	51	51
17	6.8	4.7	19	49	51	5.8	51	51	51	51	51	51
18	0	4.7	0	51	51	5.8	51	51	51	51	51	51
19	0	4.7	0	51	49	51	51	51	0	50	51	51
20	0	51	0	51	51	51	51	51	51	49	51	51
21	5.4	18	0	51	51	51	51	51	51	49	51	51
22	5.4	18	0	51	51	51	51	51	51	49	51	51
23	5.4	19	19	0	51	51	0	51	51	48	51	51
24	5.4	0	0	49	49	51	50	49	0	47	49	51
25	5.4	0	0	51	51	0	49	47	0	50	49	0
26	5.4	0	6.8	51	51	51	48	50	0	49	49	47
27	5.4	0	6.8	51	5.8	51	51	51	51	47	49	47
28	5.4	0	6.8	51	5.8	51	51	51	49	46	49	46
29	5.4	.....	6.8	51	51	51	4.9	49	40	45	46	51
30	0	.....	6.8	0	51	51	51	50	46	45	45	0
31	0	.....	6.8	.....	51	.....	51	51	.....	45	.....	51

NOTE.—Daily discharge computed from a rating curve fairly well defined above 35 second-feet.

Monthly discharge of Hanapepe ditch at Koula, near Hanapepe, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
January 25–31	51	16	27.1	376	D.
February	43	18	28.3	1,570	D
March	51	34	45.1	2,770	B.
April	51	0	45.1	2,680	B.
May	51	45	49.7	3,060	B.
June	51	51	51.0	3,030	B.
July	51	50	50.9	3,130	B.
August	51	46	49.9	3,070	B.
September	51	42	48.4	2,880	B.
October	51	43	48.5	2,980	B.
November	51	0	34.5	2,050	B.
December	51	0	42.7	2,630	B.
The period	51	0	44.7	30,200	
1911.					
January	43	0	12.1	744	D.
February	51	0	6.02	334	D.
March	19	0	9.11	560	D.
April	51	0	32.8	1,950	C.
May	51	5.8	47.8	2,940	B.
June	51	0	42.9	2,550	B.
July	51	0	44.4	2,730	B.
August	51	0	48.4	2,980	B.
September	51	0	42.8	2,550	B.
October	51	45	49.4	3,040	B.
November	51	42	49.0	2,920	B.
December	51	0	46.1	2,830	B.
The year	51	0	36.1	26,100	

HANAPEPE DITCH AT WEIR NEAR MAKAWELI, KAUAI.

The Hawaiian Sugar Co. has a measuring weir on the Hanapepe ditch below the last siphon across Hanapepe River. The records at this weir show the amount of water delivered by the ditch at the cane fields.

The monthly flow for 1910 and 1911 has been furnished to the Geological Survey by the Hawaiian Sugar Co.

Monthly discharge of Hanapepe ditch at weir near Makaweli, Kauai, for 1910–11.

Month.	1910		1911	
	Mean discharge in second-feet.	Run-off (total in acre-feet).	Mean discharge in second-feet.	Run-off (total in acre-feet).
January	[a] 14.7	204	[f] 9.73	540
February	[b] 28.7	1,480	[g] 11.3	247
March	40.6	2,500	[h] 13.3	554
April	[c] 41.3	2,210	31.3	1,860
May	38.4	2,360	45.5	2,800
June	.....	.....	44.2	2,630
July	46.7	2,870	[i] 44.9	2,670
August	44.2	2,720	43.6	2,680
September	41.8	2,490	[j] 46.1	2,380
October	42.4	2,610	46.7	2,870
November	[d] 31.3	1,240	45.5	2,710
December	[e] 41.2	2,370	46.1	2,830
The period	.....	23,100	.....	24,800

[a] 7 days; [b] 26 days; [c] 27 days; [d] 20 days; [e] 29 days; [f] 28 days; [g] 11 days; [h] 21 days; [i] 30 days; [j] 26 days.

NOTE.—Monthly mean head in inches (on 5.75-foot weir from Jan. 1 to June 5, 1910, and on 12-foot weir after June 5) furnished by the Hawaiian Sugar Co. As the discharge varies as the three-halves power of the head, the above figures may be considerably in error.

HILOA STREAM AT HANAPEPE FALLS, NEAR ELEELE, KAUAI.

Hiloa Stream, the principal branch of Hanapepe River, joins the Hanapepe from the west only a few hundred feet below the foot of Hanapepe Falls. Hiloa ditch diverts water from the west side a short distance above the confluence of the two streams.

A gaging station was established at the ditch intake November 21, 1911. The gage is graduated in tenths of feet and is fastened to the stone abutment on the right bank so that the zero is about level with the crest of the diversion dam. The dam is 75 feet long, 3 feet wide at the crest, and about 5 feet high. Measurements are made by wading on the smooth concrete surface of the crest. The flow over the dam does not include the flow through Hiloa ditch.

Discharge measurements of Hiloa Stream at Hanapepe Falls, near Eleele, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 21[a]	W. V. Hardy	75	14.2	0.28	9.6

[a] Measurement made by wading on crest of dam, which is 3 feet wide and 75 feet long. The zero of the gage is about 0.15 foot below the average level of the crest.

Daily gage height, in feet, of Hiloa Stream at Hanapepe Falls, near Eleele, Kauai, for 1911.

[S. W. Holmer, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.0	11		1.2	21	0.3	0.6
2		.0	12		.6	22	.2	.2
3		.0	13		.4	23	.2	.15
4		.0	14		.35	24	.0	.15
5		.0	15		.6	25	.0	.0
6		0.7	16		.6	26	.0	.0
7		.15	17		.0	27	.0	.0
8		.95	18		.0	28	.0	.0
9		.0	19		.0	29	.0	.0
10		.0	20		.0	30	.0	.0
						31		.0

Daily discharge, in second-feet, of Hiloa Stream at Hanapepe Falls, near Eleele, Kauai, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.0	11		162	21	12	61
2		.0	12		61	22	2.7	2.7
3		.0	13		26	23	2.7	.2
4		.0	14		18	24	.0	.2
5		.0	15		61	25	.0	.0
6		82	16		61	26	.0	.0
7		.2	17		.0	27	.0	.0
8		143	18		.0	28	.0	.0
9		.0	19		.0	29	.0	.0
10		.0	20		.0	30	.0	.0
						31		.0

NOTE.—Daily discharge determined by one measurement on crest of dam, which is 3 feet wide and 75 feet long, and a curve for a broad-crested weir. The table does not include the water diverted by the Hiloa branch of the Hanapepe ditch.

HILOA DITCH AT HANAPEPE FALLS NEAR ELEELE, KAUAI.

Hiloa ditch is the chief supply for the main Hanapepe ditch. It takes water from the west side of Hiloa Stream only a short distance above the confluence of Hiloa and Hanapepe streams. It joins Hanapepe ditch about 550 feet below its intake.

A gaging station was established on this ditch November 22, 1911. The station is in the open ditch about 335 feet below the intake. The gage is graduated in tenths of feet and is spiked to the retaining wall on the left bank. Measurements are made from a board used as a footbridge.

This station gives the total flow of Hiloa Stream at low stages, when the ditch carries all the water.

Discharge measurements of Hiloa ditch at Hanapepe Falls, near Eleele, Kauai, 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 22	W. V. Hardy	6.5	14.5	2.00	38.9

NOTE.—Additional measurements made early in 1912 were used in determining the rating.

Daily gage height, in feet, of Hiloa ditch at Hanapepe Falls, near Eleele, Kauai, for 1911.

[S. W. Holmes, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		1.7	11		2.4	21		2.05
2		1.7	12		2.0	22	2.0	2.0
3			13		1.9	23	2.0	2.05
4		1.8	14		2.0	24	2.0	
5		1.7	15		2.1	25	1.95	
6		2.5	16		2.1	26		1.85
7		2.15	17			27	1.95	1.8
8		2.55	18			28	1.9	1.8
9			19		2.05	29	1.8	1.95
10			20		1.9	30	1.75	2.15
						31		1.8

Daily discharge, in second-feet, of Hiloa ditch at Hanapepe Falls, near Eleele, Kauai, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		32	11		48	21		40
2		32	12		39	22	39	39
3		a 33	13		37	23	39	40
4		34	14		39	24	39	a 39
5		32	15		41	25	38	a 37
6		51	16		41	26	a 38	36
7		42	17		a 41	27	38	34
8		52	18		a 40	28	37	34
9		a 51	19		40	29	34	38
10		a 49	20		37	30	33	42
						31		34

a Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve that is poorly defined. The table shows the amount of water diverted from the Hiloa branch of Hanapepe River a short distance above the confluence of the two streams.

Monthly discharge of Hiloa ditch at Hanapepe Falls, near Eleele, Kauai, for Nov. 22 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 22-30	39	33	37.2	663	C.
December	52	32	39.5	2,430	C.

HANAMAULU RIVER BASIN.

HANAMAULU RIVER AT KAPAIA, NEAR LIHUE, KAUAI.

Hanamaulu River rises north of Kilohana Crater and flows east in a sinuous course through comparatively an open country to the ocean through Hanamaulu Bay. Its total length is 8 to 10 miles. It drains the northern and eastern slopes of Kilohana tufa cone (elevation, 1,134 feet), and its basin is north of Nawiliwili basin and south of the basin of the Wailua. The rainfall ranges from 50 inches near the sea to 100 inches at the source. Considerable rice is grown in the lower valley.

A gaging station was established on Hanamaulu River at the highway bridge in Kapaia village September 4, 1911. The gage, graduated in tenths of feet, is fastened to the bridge pier on the right bank. Low-water measurements are made by wading. At high stages measurements are made from the downstream side of the bridge.

The bed of the stream is rocky, but fair conditions for measurements exist. Water is diverted a short distance below the station for rice irrigation in the valley.

Discharge measurements of Hanamaulu River at Kapaia, near Lihue, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 4	W. V. Hardy	14	14.4	5.17	10.5
27	do	14	24.1	5.80	35.6

NOTE.—Additional measurements made early in 1912 were used in determining the rating. Measurements made by wading at various sections.

Daily gage height, in feet, of Hanamaulu River at Kapaia, near Lihue, Kauai, for 1911.

[J. K. Gandall, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	5.2	5.3	16	.....	5.5	5.3	5.4
2	.....	5.7	5.3	5.2	17	.....	5.2	5.2	.....
3	.....	5.7	5.3	.....	18	.....	5.2	5.2	5.4
4	.....	5.7	5.4	5.1	19	.....	5.2	.....	5.3
5	.....	5.7	.....	5.1	20	.....	5.1	5.7	5.2
6	.....	5.6	5.4	5.1	21	.....	5.1	5.5	5.0
7	.....	5.6	5.4	5.3	22	.....	.....	5.2	5.3
8	.....	.....	5.6	5.2	23	.....	5.2	5.7	5.55
9	.....	5.6	5.3	5.0	24	.....	5.2	5.8	.....
10	.....	5.6	5.3	.....	25	.....	5.2	5.95	.....
11	.....	5.5	5.4	5.4	26	.....	5.1	.....	5.1
12	.....	5.4	.....	5.4	27	5.8	5.1	5.8	5.0
13	.....	5.6	5.4	5.4	28	5.8	5.1	5.35	5.7
14	.....	5.8	5.4	5.3	29	5.7	.....	5.3	5.7
15	.....	.....	5.4	5.2	30	5.7	5.1	5.3	5.6
					31	.....	5.1	.....	.....

Daily discharge, in second-feet, of Hanamaulu River at Kapaia, near Lihue, Kauai, for 1911.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	31	11	14	16	.....	22	14	18
2	.....	31	14	11	17	.....	11	11	18
3	.....	31	14	9.8	18	.....	11	11	18
4	.....	31	18	8.6	19	.....	11	21	14
5	.....	31	18	8.6	20	.....	8.6	31	11
6	.....	27	18	8.6	21	.....	8.6	22	6.6
7	.....	27	18	14	22	.....	9.8	11	14
8	.....	27	27	11	23	.....	11	31	24
9	.....	27	14	6.6	24	.....	11	36	19
10	.....	27	14	12	25	.....	11	42	14
11	.....	22	18	18	26	.....	8.6	39	8.6
12	.....	18	18	18	27	36	8.6	36	6.6
13	.....	27	18	18	28	36	8.6	16	31
14	.....	36	18	14	29	31	8.6	14	31
15	.....	29	18	11	30	31	8.6	14	27
					31	.....	8.6	.....	19

NOTE.—Daily discharge computed from a rating curve that is fairly well defined. No gage-height reading was obtained on Sundays, hence the discharge is interpolated for those days.

Monthly discharge of Hanamaulu River at Kapaia, near Lihue, Kauai, for Sept. 27 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
September 27–30	.....	.....	33.5	266	
October	36	8.6	19.0	1,170	B.
November	42	11	20.2	1,200	B.
December	31	6.6	14.9	916	B.

WAILUA RIVER BASIN.

GENERAL FEATURES.

Wailua River basin is the largest basin on windward Kauai. It lies north of the Hanamaulu and Huleia basins, east of Hanapepe and Olokele basins, south of Hanalei and Kalihiwai basins, and west and south of Kapaa basin. It comprises an area of 45 or 50 square miles, which is only slightly less than the area of Waimea basin on the leeward side. In shape it is roughly trapezoidal, with the long base at the southeast about 11 miles long, and the short base at the northwest, along the divide from Waialeale northeastward, 6 to 7 miles long. The west leg, from Waialeale southward, is 4 to 5 miles in length, and the east leg, from Kapehuaala southeastward to the mouth, is 7 to 8 miles in length.

The Wailua basin consists for the most part of comparatively open rolling country—a sort of plain with a few isolated hills—lying east of the Waialeale mountain mass and west of Kalepa Ridge, which has been intersected by the lower river on its way to the sea. This ridge is about 5 miles long, 600 feet high, and parallels the seashore about a mile inland. Aahoaka and Hanahanapuni are the most prominent individual hills in the basin.

Wailua River has two main branches which drain approximately equal areas and unite just west of the cut through Kalepa Ridge about 1½ miles from the sea. The South Fork drains the area that lies south of Hanahanapuni and Kawaikini, and is practically all on fee-simple land. The North Fork drains the area north of Hanahanapuni and east of Waialeale and the ridge to the northeast, and is practically all on public lands. Each fork has several important branches which unite at elevation about 500 feet. Below the junction of the different branches each stream occupies a well-developed channel that increases in depth toward the sea until it attains the proportions of a considerable gorge with rather high falls at the head. Opaikaa Stream is tributary to the lower main Wailua from the north.

The rainfall in Wailua basin probably ranges from 120 inches at Hanahanapuni to 300 inches in the northern mountains and 400 inches at Waialeale. The upper part of the basin is very steep—precipitous palis, or cliffs, 2,000 to 3,000 feet high around Waialeale—and the run-off is very rapid. The fluctuations in flow are not only very great but exceedingly rapid. The streams may rise and fall several feet at a time for half a dozen times or more in a few hours. Perhaps Wailua River exemplifies these fluctuations better than any other stream in the islands. (See clock record of stage for North Fork of Wailua River, fig. 2, p. 102.)

Water is diverted from both forks of Wailua River for irrigating cane on the higher lands and rice on the low valley lands along the

river. Considerable rice is grown in the valley near the mouth of the river and in small isolated valleys much farther up. The principal ditches are Lihue and Hanamaulu from the south side of South Fork, and Kanaha from the south side of North Fork.

Gaging stations are maintained on South Fork and the two ditches taking water above and on North Fork and the ditch diverting water above the station.

The Wailua River basin undoubtedly offers better storage sites than any other basin in the islands. In fact, it is one of the few basins in which storage reservoirs in the bed of the stream seems practicable.

SOUTH FORK OF WAILUA RIVER AT SIPHON NEAR LIHUE, KAUAI.

A gaging station was established on South Fork of Wailua River at the crossing of the Kanaha ditch siphon July 1, 1910. The station is below the intakes for Lihue and Hanamaulu ditches and also a few hundred feet below the power line of the Kauai Electric Co.

The equipment consists of a staff gage on the left bank graduated in tenths of feet, and the siphon steel-truss bridge from which measurements are made. At low water measurements are made by wading.

The channel is straight underneath the bridge, but the thread of the current makes an angle of about 52° with the bridge. In all measurements from the bridge a reduction factor, determined by actual measurements, has been used in order to correct for the skew of the bridge. The bed of the stream consists of bowlders, some of which were removed in order to improve the section.

The stream is 50 feet wide at low water, and the maximum range of stage is at this point 6 to 8 feet. The stream overflows its right bank at moderately high stages and forms a second channel which can not be measured.

This station was abandoned at the end of 1911 and a new one established much farther downstream.

Discharge measurements of South Fork of Wailua River at siphon near Lihue, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 14[a]	A. G. Schnack	52	97	1.9	35
18[a]	.....do	72	306	5.25	1,030
18[a]	.....do	61	203	3.72	355
Aug. 2[a]	.....do	52	84	1.66	31.6
29[a]	.....do	53	112	2.3	85
Sept. 30[a]	Martin and Pierce	52	123	2.62	102
Nov. 22[b]	W. F. Martin	39	59	2.05	62
1911.					
May 5[a]	W. F. Martin	34	48.2	1.89	34.5
5[b]	.....do	45	55	1.88	35.1

[a] Measurement made from siphon bridge, which makes an angle of about 52° with the axis of the stream. A factor of 0.62 was used to reduce measured area to rectangular cross section.
[b] Measurement made by wading.

Daily gage height, in feet, of South Fork of Waiua River at siphon near Lihue, Kauai, for 1910–11.

[Mori, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	2.30	1.75	1.60	2.30	2.50	2.30	16	1.65	1.70	2.25	1.75	2.35	1.70
2	2.30	1.65	1.60	2.05	6.30	2.30	17	1.60	1.60	1.55	1.80	2.30	1.80
3	2.55	1.65	1.55	1.95	4.40	2.20	18	2.00	1.50	1.50	1.95	2.05	1.80
4	3.05	2.40	1.95	2.30	4.25	2.10	19	1.80	1.40	2.35	2.10	1.90	1.68
5	2.40	3.55	1.55	1.85	3.40	2.15	20	3.85	2.40	2.50	1.75	2.10	1.40
6	2.15	3.10	1.45	1.75	3.15	2.40	21	1.90	3.95	2.90	1.70	2.10	1.30
7	2.00	2.20	1.60	1.70	3.00	2.10	22	1.75	2.45	2.65	1.70	2.10	1.30
8	1.95	2.20	1.40	2.60	3.05	2.10	23	1.60	1.95	2.55	2.00	2.10	2.55
9	1.85	2.25	1.65	2.65	3.15	2.20	24	1.75	1.75	2.70	2.00	2.15	3.10
10	1.85	2.15	1.45	2.00	3.55	2.15	25	1.70	3.90	2.85	1.55	2.30	5.50
11	1.70	1.95	1.85	1.75	3.60	2.00	26	1.55	2.50	2.80	1.50	3.65	5.75
12	2.15	1.75	2.70	3.15	3.15	2.00	27	2.20	2.45	2.30	2.70	2.40	4.85
13	2.05	1.65	2.55	5.75	3.00	2.00	28	2.45	2.15	3.70	3.70	2.15	2.72
14	1.90	2.15	1.75	2.75	2.75	1.95	29	2.30	2.05	2.30	3.05	2.60	2.62
15	1.75	2.10	2.35	2.15	2.50	1.70	30	1.90	1.85	2.25	2.90	2.35	5.75
							31	1.85	1.75	.....	2.70	.....	3.15

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	2.55	4.80	2.45	2.20	1.98	3.10	2.30	2.28	2.00	3.05	1.35	2.22
2	2.48	5.00	2.22	2.20	1.82	3.22	2.40	2.20	1.78	2.95	1.22	2.20
3	2.40	3.52	2.20	2.10	1.82	3.80	2.20	2.20	1.70	3.45	1.20	2.15
4	2.30	3.35	2.20	2.30	1.78	3.70	2.60	2.15	1.62	3.00	1.20	2.10
5	2.40	4.85	2.20	2.25	1.80	3.08	2.00	2.10	1.80	2.65	1.25	2.20
6	2.52	3.30	2.20	2.00	1.80	3.20	2.15	2.10	2.15	2.58	1.60	3.10
7	2.60	3.20	2.28	2.00	1.85	3.70	1.95	1.92	2.10	2.50	1.72	2.35
8	8.48	4.85	2.90	1.70	1.82	3.05	2.00	2.02	2.05	2.50	1.75	3.32
9	3.85	3.40	2.80	1.70	2.05	2.62	2.00	2.05	2.20	2.35	1.80	5.66
10	3.55	3.70	2.42	1.70	2.35	2.30	2.65	2.65	2.20	2.30	1.85	4.60
11	2.65	3.45	2.35	1.70	1.82	2.30	2.65	2.50	3.55	2.30	2.50	3.30
12	5.45	3.25	2.28	1.70	1.82	2.25	2.25	3.05	2.65	2.15	2.18	4.80
13	4.05	3.02	2.12	2.30	1.75	3.60	2.12	2.65	2.52	2.10	3.15	3.20
14	3.90	2.92	2.00	2.40	1.70	4.05	2.15	2.60	2.35	2.05	2.75	3.20
15	3.25	2.75	1.98	1.78	1.95	2.95	2.00	2.32	3.10	2.02	3.05	3.15
16	3.02	2.75	2.08	2.28	2.55	2.78	2.40	2.22	2.35	2.00	2.75	3.40
17	3.35	2.60	2.08	2.82	2.30	2.75	2.28	2.22	3.80	1.92	2.55	3.08
18	2.95	2.45	2.02	2.60	1.95	2.35	1.90	2.92	2.65	1.78	3.42	2.68
19	3.75	2.30	2.00	3.25	1.75	2.20	1.90	2.70	2.25	1.65	4.35	3.00
20	3.00	2.30	2.10	3.25	2.05	2.10	2.15	3.05	3.60	1.60	2.55	2.92
21	2.85	2.35	2.10	3.75	3.45	2.80	2.25	2.30	2.62	1.50	2.40	2.38
22	2.55	2.28	2.18	3.00	4.15	2.30	2.20	2.00	6.78	1.50	2.30	2.68
23	3.35	2.25	2.22	3.32	2.40	3.00	2.05	2.00	5.40	1.50	2.20	2.55
24	3.65	2.55	2.15	2.75	2.45	2.40	2.02	2.00	8.14	1.52	2.08	2.50
25	3.30	2.50	3.78	2.25	2.18	2.48	1.82	1.92	4.35	1.55	2.40	2.32
26	4.15	3.15	3.75	2.15	2.15	2.45	1.80	1.88	3.85	1.50	2.40	2.20
27	4.50	2.78	2.70	4.85	2.20	2.55	3.30	1.90	3.80	1.42	2.60	2.20
28	7.26	2.52	2.45	2.80	5.00	2.85	4.02	1.80	3.52	1.35	2.38	2.40
29	4.95	.....	2.00	2.35	3.55	2.90	2.65	1.72	3.05	1.30	2.30	2.50
30	2.95	.....	2.00	2.10	3.25	2.62	2.40	2.35	3.00	1.30	2.15	2.65
31	3.95	.....	1.98	.....	3.52	.....	2.25	2.25	.....	1.42	.....	2.25

Daily discharge, in second-feet, of South Fork of Wailua River at siphon near Lihue, Kauai, for 1910–11.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	75	31	23	75	98	75	16	26	28	70	31	80	28
2	75	26	23	52	1,620	75	17	23	23	20	34	75	34
3	104	26	20	44	610	65	18	48	18	18	44	52	34
4	187	86	44	75	545	56	19	34	14	80	56	41	27
5	86	307	20	38	267	60	20	396	86	98	31	56	14
6	60	197	16	31	208	86	21	41	430	158	28	56	11
7	48	65	23	28	177	56	22	31	92	118	28	56	11
8	44	65	14	111	187	56	23	23	44	104	48	56	104
9	38	70	26	118	208	65	24	31	31	125	48	60	197
10	38	60	16	48	307	60	25	28	413	150	20	75	1,160
11	28	44	38	31	321	48	26	20	98	141	18	336	1,300
12	60	31	125	208	208	48	27	65	92	75	125	86	820
13	52	26	104	1,300	177	48	28	92	60	350	350	60	128
14	41	60	31	133	133	44	29	75	52	75	187	111	114
15	31	56	80	60	98	28	30	41	38	70	158	80	1,300
							31	38	31	.....	125	.....	208

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	104	795	92	65	47	197	75	73	48	187	12	67
2	96	895	67	65	35	224	86	65	33	168	8.6	65
3	86	299	65	56	35	380	65	65	28	280	8.0	60
4	75	254	65	75	33	350	111	60	24	177	8.0	56
5	86	820	65	70	34	193	48	56	34	118	9.5	65
6	101	242	65	48	34	219	60	56	60	108	23	197
7	111	219	73	48	38	350	44	42	56	98	29	80
8	2,930	820	158	28	35	187	48	50	52	98	31	247
9	396	267	141	28	52	114	48	52	65	80	34	1,250
10	307	350	88	28	80	75	118	118	65	75	38	700
11	118	280	80	28	35	75	118	98	307	75	98	242
12	1,140	230	73	28	35	70	70	187	118	60	63	795
13	466	181	58	75	31	321	58	118	101	56	208	219
14	413	162	48	86	28	466	60	111	80	52	133	219
15	230	133	47	33	44	168	48	77	197	50	187	208
16	181	133	54	73	104	138	86	67	80	48	133	267
17	254	111	54	144	75	133	73	67	380	42	104	193
18	168	92	50	111	44	80	41	162	118	33	272	122
19	365	75	48	230	31	65	41	125	70	26	588	177
20	177	75	56	230	52	56	60	187	321	23	104	162
21	150	80	56	365	280	141	70	75	114	18	86	84
22	104	73	63	177	505	75	65	48	1,910	18	75	122
23	80	70	67	247	86	117	52	48	1,110	18	65	104
24	118	104	60	133	92	86	50	48	2,720	19	54	98
25	242	98	374	70	63	96	35	42	588	20	86	77
26	505	208	365	60	60	92	34	40	396	18	86	65
27	655	138	125	820	65	104	242	41	380	15	111	65
28	2,200	101	92	141	895	150	455	34	299	12	84	86
29	870	.....	48	80	307	158	118	29	187	11	75	98
30	168	.....	48	56	230	114	86	80	177	11	60	118
31	430	.....	47	.....	299	.....	70	70	.....	15	.....	70

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 1,100 second-feet. The table does not include the water in Lihue and Hanamaulu ditches, which divert water above the station.

Monthly discharge of South Fork of Wailua River at siphon near Lihue, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July	396	20	63.8	3,920	B.
August	430	14	87.1	5,360	B.
September	350	14	75.2	4,470	B.
October	1,300	18	119	7,320	B.
November	1,620	41	215	12,800	B.
December	1,300	11	205	12,600	B.
The period				46,500	
January	2,930	75	430	26,400	B.
February	895	70	261	14,500	B.
March	374	47	90.1	5,540	B.
April	820	28	123	7,320	B.
May	895	28	122	7,500	B.
June	466	56	166	9,880	B.
July	455	34	85.0	5,230	B.
August	187	29	77.1	4,740	B.
September	2,720	24	337	20,100	B.
October	280	11	65.5	4,030	B.
November	588	8.0	95.8	5,700	B.
December	1,250	56	206	12,700	B.
The year	2,930	8.0	171	124,000	

NOTE.—The above figures do not include the water diverted by Lihue and Hanamaulu ditches above the station on the river.

SOUTH FORK OF WAILUA RIVER ABOVE WAIEHU FALLS, NEAR LIHUE, KAUAI.

A gaging station was established on South Fork of Wailua River, about half a mile above Waiehu Falls, December 10, 1911. This station is about 3 miles below the old station at the siphon, and about 5 miles north of Lihue.

Gage heights are obtained by means of a Friez clock register installed on the right bank. A cable, with car, is used for making measurements.

The river is straight under the cable and has a fine section. At low water the channel is wide, and the current rather sluggish. The extreme range of stage is probably 9 or 10 feet.

The discharge at this station shows the amount of water going over Waiehu Falls and down to sea, except such as may be used for rice irrigation in the lower valley.

Discharge measurements of South Fork of Wailua River above Waiehu Falls, near Lihue, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 18	W. V. Hardy	80	175	4.10	203

NOTE.—Additional measurements made early in 1912 were used in determining the rating.

Daily gage height, in feet, of South Fork of Wailua River above Waiehu Falls, near Lihue, Kauai, for 1911.

[Gus. Schilling, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
10	4.15	18	4.0	26	3.65
11	5.8	19	4.0	27	3.65
12	6.2	20	3.9	28	3.7
13	5.85	21	3.85	29	3.9
14	4.15	22	3.85	30	4.3
15	4.1	23	3.75	31	3.85
16	4.6	24	3.65		
17	4.0	25	3.65		

Daily discharge, in second-feet, of South Fork of Wailua River at Waiehu Falls, near Lihue, Kauai, for 1911.

Day.	Dec.	Day.	Dec.	Day.	Dec.
10	220	18	171	26	79
11	870	19	171	27	79
12	1,050	20	142	28	90
13	890	21	128	29	142
14	220	22	128	30	273
15	203	23	102	31	128
16	390	24	79		
17	171	25	79		

NOTE.—Daily discharge computed from a rating curve fairly well defined.

LIHUE DITCH NEAR LIHUE, KAUAI.

Lihue ditch diverts water from the south side of Waiahi Stream, one of the branches of South Fork of Wailua River, at elevation somewhat less than 600 feet. About 1½ miles below the intake it unites with Kanaha ditch which brings water from North Fork across South Fork in an inverted siphon, and the larger Lihue ditch continues southward as a high-level ditch for the upper cane lands of the Lihue Plantation Co.

A gaging station was established on Lihue ditch July 1, 1910, about 200 feet above the junction with Kanaha ditch and near the Kauai Electric Co.'s trail. It is below the gate that regulates the outflow to Hanamaulu ditch at a lower level, and only a few hundred feet above the station on the river.

The equipment consists of a staff gage on the right bank. Measurements are made by wading. This station, in connection with the Hanamaulu station, shows the quantity of water taken from the South Fork above the station on the river.

Discharge measurements of Lihue ditch near Lihue, Kauai, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 18	A. G. Schnack	6.0	8.4	1.50	10.5
Aug. 29	do	5.5	8.2	1.44	9.0
Sept. 30	Martin and Pierce	5.1	7.8	1.50	9.0

NOTE.—An additional measurement made early in 1912 was used in determining the rating. Measurements made by wading at various sections.

Daily gage height, in feet, of Lihue ditch near Lihue, Kauai, for 1910–11.

[Mori, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	1.1	1.5	1.4	1.5	1.2	1.3	16	1.4	1.5	1.5	1.5	.....	1.4
2	1.1	1.4	1.4	1.4	1.4	1.1	17	1.4	1.5	1.5	1.4	.....	1.4
3	1.1	1.45	1.4	1.4	.....	1.1	18	1.35	1.5	1.5	1.4	.....	1.4
4	1.15	1.5	1.5	1.5	.....	1.1	19	1.4	1.5	1.5	1.4	.....	1.4
5	1.05	1.5	1.4	1.5	.....	1.1	20	1.45	1.5	1.5	1.5	1.3	1.4
6	1.0	1.5	1.4	1.5	.....	1.2	21	1.5	1.3	1.5	1.5	1.3	1.3
7	1.0	1.5	1.4	1.4	.....	1.2	22	1.6	1.5	1.5	1.5	1.3	1.3
8	1.0	1.5	1.4	1.5	.....	1.2	23	1.5	1.4	1.5	1.5	1.3	1.5
9	1.0	1.4	1.4	1.5	.....	1.2	24	1.6	1.5	1.4	1.5	1.3	1.5
10	1.1	1.5	1.4	1.5	.....	1.2	25	1.5	1.4	1.4	1.4	1.3	1.1
11	1.3	1.5	1.4	1.5	.....	1.2	26	1.5	1.5	1.4	1.5	1.4	1.1
12	1.4	1.5	1.4	1.5	.....	1.2	27	1.5	1.5	1.5	1.5	1.3	1.1
13	1.4	1.5	1.5	1.5	.....	1.2	28	1.45	1.5	1.5	1.5	1.3	1.1
14	1.4	1.5	1.5	1.5	.....	1.2	29	1.5	1.5	1.5	1.4	1.2	1.4
15	1.4	1.5	1.5	1.5	.....	1.4	30	1.5	1.4	1.5	1.2	1.2	1.2
							31	1.5	1.4	.....	1.2	.....	1.4

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.35	1.2	0.40	.....	1.5	1.5	1.4	.....	1.4	.....	1.6	.....
2	1.2	1.2	.40	.....	1.5	1.5	1.4	.....	1.4	.....	1.6	.....
3	1.2	1.2	.....	.....	1.5	1.5	1.4	.....	1.4	.....	1.6	.....
4	1.2	1.2	.....	0.9	1.5	1.4	1.4	.....	1.4	.....	1.6	.....
5	1.2	1.2	.....	1.0	1.5	1.5	1.4	.....	1.45	.....	1.6	.....
6	1.2	1.2	.....	1.0	1.5	1.5	1.4	.....	1.5	.....	1.6	.....
7	1.2	1.2	.....	1.0	1.5	1.5	1.4	.....	1.5	.....	1.6	.....
8	1.2	1.2	.....	1.0	1.5	1.5	1.4	.....	1.5	.....	1.6	.....
9	1.2	1.2	.....	1.0	1.5	1.5	1.4	.....	1.5	.....	1.6	.....
10	1.2	1.2	.....	1.0	1.55	1.4	1.4	.....	1.5	.....	1.6	.....
11	1.2	1.2	.....	1.1	1.5	1.4	1.4	.....	1.6	.....	1.6	.....
12	1.2	1.2	.....	1.4	1.5	1.4	1.5	.....	1.5	.....	1.6	.....
13	1.2	1.2	.....	1.4	1.45	1.5	1.5	.....	1.5	.....	1.6	.....
14	.....	1.1	1.45	1.5	1.5	1.5	1.5	.....	1.5	.....	1.6	.....
15	.....	.7	1.5	1.5	1.5	1.5	1.5	.....	1.55	.....	1.6	.....
16	.....	.....	1.4	1.5	1.5	1.4	1.5	.....	1.5	.....	1.6	.....
17	.....	.....	1.5	1.5	1.5	1.4	1.4	.....	1.6	1.2	1.6	.....
18	.....	.....	1.5	1.5	1.5	1.4	1.3	.....	1.5	1.2	1.6	.....
19	.....	.....	1.5	1.5	1.5	1.4	1.4	.....	1.5	1.3	1.6	.....
20	.....	.....	1.5	1.5	1.5	1.4	1.5	.....	1.6	1.4	1.6	.....
21	.....	.....	1.2	1.5	1.5	1.5	.....	.....	1.6	1.4	1.3	.....
22	.....	.....	1.2	1.5	1.6	1.5	.....	.....	.....	1.4	1.3	.....
23	.7	.....	.7	1.5	1.5	1.5	.....	.....	.....	1.5	1.3	0.4
24	.7	.95	.7	1.5	1.5	1.5	.....	.....	.....	1.5	1.3	.4
25	1.2	.75	.8	1.5	1.5	1.5	.....	.....	.....	1.5	1.3	.4
26	1.2	.40	.8	1.5	1.5	1.5	.....	.....	.....	1.5	1.3	.4
27	1.2	.40	.8	1.5	1.5	1.5	.....	.....	.....	1.5	1.3	.7
28	1.2	.40	.8	1.5	1.5	1.5	.....	.....	.....	1.5	.....	.7
29	1.2	.....	.8	1.5	1.5	1.5	.....	.....	.....	1.5	.....	.7
30	1.2	.....	.8	1.5	1.5	1.5	.....	.....	.....	1.5	.....	.....
31	1.2	.....	.8	.....	1.2	.....	.....	1.4	.....	1.5	.....	.....

Daily discharge, in second-feet, of Lihue ditch near Lihue, Kauai, for 1910–11.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	7.4	10	9.6	10	8.1	8.8	16	9.6	10	10	10	.....	9.6
2	7.4	9.6	9.6	9.6	9.6	7.4	17	9.6	10	10	9.6	.....	9.6
3	7.4	9.8	9.6	9.6	.....	7.4	18	9.2	10	10	9.6	.....	9.6
4	7.8	10	10	10	.....	7.4	19	9.6	10	10	9.6	.....	9.6
5	7.1	10	9.6	10	.....	7.4	20	9.8	10	10	10	8.8	9.6
6	6.8	10	9.6	10	.....	8.1	21	10	8.8	10	10	8.8	8.8
7	6.8	10	9.6	9.6	.....	8.1	22	11	10	10	10	8.8	8.8
8	6.8	10	9.6	10	.....	8.1	23	10	9.6	10	10	8.8	10
9	6.8	9.6	9.6	10	.....	8.1	24	11	10	9.6	10	8.8	10
10	7.4	10	9.6	10	.....	8.1	25	10	9.6	9.6	9.6	8.8	7.4
11	8.8	10	9.6	10	.....	8.1	26	10	10	9.6	10	9.6	7.4
12	9.6	10	9.6	10	.....	8.1	27	10	10	10	10	8.8	7.4
13	9.6	10	10	10	.....	8.1	28	9.8	10	10	10	8.8	7.4
14	9.6	10	10	10	.....	8.1	29	10	10	10	9.6	8.1	9.6
15	9.6	10	10	10	.....	9.6	30	10	9.6	10	8.1	8.1	8.1
							31	10	9.6	.....	8.1	.....	9.6

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	9.2	8.1	4.0	.....	10	10	9.6	.....	9.6	.....	11	.....
2	8.1	8.1	4.0	.....	10	10	9.6	.....	9.6	.....	11	.....
3	8.1	8.1	.....	.....	10	10	9.6	.....	9.6	.....	11	.....
4	8.1	8.1	.....	6.2	10	9.6	9.6	.....	9.6	.....	11	.....
5	8.1	8.1	.....	6.8	10	10	9.6	.....	9.8	.....	11	.....
6	8.1	8.1	.....	6.8	10	10	9.6	.....	10	.....	11	.....
7	8.1	8.1	.....	6.8	10	10	9.6	.....	10	.....	11	.....
8	8.1	8.1	.....	6.8	10	10	9.6	.....	10	.....	11	.....
9	8.1	8.1	.....	6.8	10	10	9.6	.....	10	.....	11	.....
10	8.1	8.1	.....	6.8	10	9.6	9.6	.....	10	.....	11	.....
11	8.1	8.1	.....	7.4	10	9.6	9.6	.....	11	.....	11	.....
12	8.1	8.1	.....	9.6	10	9.6	10	.....	10	.....	11	.....
13	8.1	8.1	.....	9.6	9.8	10	10	.....	10	.....	11	.....
14	.....	7.4	9.8	10	10	10	10	.....	10	.....	11	.....
15	.....	5.2	10	10	10	10	10	.....	10	.....	11	.....
16	.....	.....	9.6	10	10	9.6	10	.....	10	.....	11	.....
17	.....	.....	10	10	10	9.6	9.6	.....	11	8.1	11	.....
18	.....	.....	10	10	10	9.6	8.8	.....	10	8.1	11	.....
19	.....	.....	10	10	10	9.6	9.6	.....	10	8.8	11	.....
20	.....	.....	10	10	10	9.6	10	.....	11	9.6	11	.....
21	.....	.....	8.1	10	10	10	.....	.....	11	9.6	8.8	.....
22	.....	.....	8.1	10	11	10	.....	.....	.....	9.6	8.8	.....
23	5.2	.....	5.2	10	10	10	.....	.....	.....	10	8.8	4.0
24	5.2	6.5	5.2	10	10	10	.....	.....	.....	10	8.8	4.0
25	8.1	5.4	5.7	10	10	10	.....	.....	.....	10	8.8	4.0
26	8.1	4.0	5.7	10	10	10	.....	.....	.....	10	8.8	4.0
27	8.1	4.0	5.7	10	10	10	.....	.....	.....	10	8.8	5.2
28	8.1	4.0	5.7	10	10	10	.....	.....	.....	10	.....	5.2
29	8.1	.....	5.7	10	10	10	.....	.....	.....	10	.....	5.2
30	8.1	.....	5.7	10	10	10	.....	.....	.....	10	.....	.....
31	8.1	.....	5.7	.....	8.1	.....	.....	9.6	.....	10	.....	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 6 and 12 second-feet. Ditch dry on days for which no discharge is given.

Monthly discharge of Lihue ditch near Lihue, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
July	11	6.8	8.98	552	B.
August	10	8.8	9.88	607	B.
September	10	9.6	9.82	584	B.
October	10	8.1	9.78	601	B.
November 1–2 and 20–30	9.6	8.1	8.76	226	B.
December	10	7.4	8.50	523	B.
The period				3,090	
1911.					
January 1–13 and 23–31	9.2	5.2	7.89	344	B.
February 1–15 and 24–28	8.1	4.0	7.09	282	B.
March 1–2 and 14–31	10	4.0	7.20	285	B.
April 4–30	10	6.2	9.02	483	B.
May	11	8.1	9.96	612	B.
June	10	9.6	9.88	588	B.
July 1–20	10	8.8	9.68	384	B.
August 31	9.6	9.6	9.6	19	
September 1–21	11	9.6	10.1	421	B.
October 17–31	10	8.1	7.59	285	B.
November 1–27	11	8.8	10.4	559	B.
December 23–29	5.2	4.0	4.23	58	C.
The period	11	4.0	9.04	4,320	

NOTE.—Figures of minimum and mean discharges are only for days when ditch was carrying water. The ditch was dry during the periods Nov. 3–19, 1910: Jan. 14–22, Feb. 16–23, Mar. 3–13, Apr. 1–3, July 21 to Aug. 30, Sept. 22 to Oct. 16, Nov. 28 to Dec. 22, and Dec. 30–31, 1911.

HANAMAULU DITCH NEAR LIHUE, KAUAI.

Hanamaulu ditch takes water from the south side of the South Fork of Wailua River at the junction of the main branches at about 500 feet elevation. About half a mile below the intake water may be turned into it from the Lihue ditch at a higher level. This ditch supplies cane lands of the Lihue Plantation Co.

A gaging station was established on this ditch July 1, 1910, about half a mile below the intake and below the inflow from Lihue ditch. The old station was in the open ditch above the tunnel under the power line of the Kauai Electric Co., about 500 feet above the station on the river. In the summer of 1911, the station was moved to the flume about 100 feet farther upstream. The gage is fastened to the left side of the flume, 18 feet from the upper end.

This station, in connection with the station on Lihue ditch, shows the quantity of water taken from the South Fork above the station on the river.

Discharge measurements of Hanamaulu ditch near Lihue, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 18	A. G. Schnack	6.4	16.1	2.52	49.7
Aug. 29	....do	6.0	14.6	2.44	41.1
Sept. 30	Martin and Pierce	5.4	13.6	2.62	45.6
1911.					
Sept. 30[a]	W. V. Hardy	5.0	8.5	[b]1.65	22.2

[a] New gage established Sept. 30, 1911. This gage is about 100 feet above old gage.
[b] Old gage height was 1.81.

NOTE.—Additional measurements made early in 1912 were used in determining the rating. Measurements made at various sections.

Daily gage height, in feet, of Hanamaulu ditch near Lihue, Kauai, for 1910–11.

[Mori, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	2.4	2.6	2.6	2.6	.....	1.4	16	2.5	2.6	2.6	2.6	.....	1.2
2	2.4	2.6	2.6	2.6	2.2	1.2	17	2.5	2.6	2.6	2.6	.....	1.2
3	2.4	2.6	2.6	2.6	.....	1.2	18	2.6	2.6	2.6	2.6	.....	1.2
4	2.45	2.65	2.6	2.6	.....	1.2	19	2.6	2.6	2.6	2.6	.....	1.2
5	2.35	2.6	2.6	2.6	.....	1.2	20	2.6	2.6	2.6	2.7	1.4	1.2
6	2.35	2.6	2.6	2.6	.....	1.2	21	2.6	2.7	2.6	2.7	1.4	2.2
7	2.5	2.6	2.6	2.6	.....	1.2	22	2.6	2.6	2.6	2.6	1.4	2.2
8	2.5	2.6	2.6	2.6	.....	1.2	23	2.6	2.6	2.6	2.6	1.4	2.3
9	2.5	2.6	2.6	2.5	.....	1.2	24	2.6	2.6	2.6	2.6	1.4	2.3
10	2.5	2.6	2.6	2.5	.....	1.2	25	2.6	2.6	2.6	2.6	1.4	2.1
11	2.5	2.6	2.5	2.5	.....	1.2	26	2.6	2.6	2.6	2.6	1.5	1.2
12	2.55	2.6	2.6	2.5	.....	1.2	27	2.6	2.6	2.6	2.6	1.4	1.2
13	2.5	2.6	2.6	2.6	.....	1.2	28	2.6	2.6	2.7	2.6	1.4	1.2
14	2.5	2.6	2.6	2.6	.....	1.2	29	2.6	2.6	2.6	.....	1.6	2.7
15	2.5	2.6	2.6	2.6	.....	1.2	30	2.6	2.6	2.6	.....	1.4	1.2
							31	2.5	2.6	.....	.....	.....	1.7

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.1	1.2	1.4	1.3	2.7	2.7	2.7	1.8	2.4	1.5	2.2	.75
2	1.1	1.2	1.4	1.3	2.7	2.7	2.7	1.8	2.4	1.5	2.2	.....
3	1.1	1.2	1.4	1.3	2.7	2.7	2.7	1.8	2.4	1.5	2.2	.75
4	1.1	1.2	1.4	1.3	2.7	2.7	2.7	1.8	2.4	1.5	2.2	.75
5	1.1	1.2	1.4	1.3	2.6	2.7	2.6	1.8	2.4	1.5	2.2	.75
6	1.1	1.2	1.4	1.3	2.6	2.7	2.7	1.8	2.45	1.5	2.3	.85
7	1.1	1.2	1.4	1.3	2.6	2.7	2.6	1.8	2.4	1.5	2.3	.85
8	1.1	1.2	1.25	2.3	2.6	2.7	2.6	2.7	2.4	1.5	2.3	.85
9	1.1	1.2	1.25	2.3	2.6	2.7	2.6	2.7	2.4	1.5	2.3	.85
10	1.1	1.2	1.25	2.3	2.6	2.7	2.7	2.3	2.4	1.5	2.3	.85
11	1.1	1.2	1.25	2.3	2.6	2.7	2.7	2.3	2.5	1.5	2.3	.85
12	1.1	1.2	1.25	2.3	2.7	2.7	2.7	2.3	2.6	1.8	2.3	.85
13	1.3	1.2	1.25	2.7	2.6	2.7	2.7	2.4	2.5	1.8	2.3	.85
14	1.3	1.2	1.85	2.5	2.6	2.7	2.7	2.3	2.6	1.8	2.35	.85
15	1.3	1.2	1.85	2.5	2.6	2.7	2.7	2.3	2.6	1.8	2.35	.85
16	1.3	1.2	1.85	2.7	2.6	2.7	2.7	2.4	2.5	1.8	2.3	1.1
17	1.3	1.2	1.85	2.7	2.6	2.7	2.6	2.4	2.5	1.8	2.3	1.1
18	1.3	1.2	1.85	2.7	2.6	2.7	2.6	2.4	2.4	2.3	1.7	1.1
19	1.3	1.2	1.50	2.7	2.6	2.7	2.7	2.6	2.4	2.3	1.7	1.1
20	1.3	1.2	1.30	2.7	2.6	2.6	2.7	2.6	2.5	2.3	1.3	1.1
21	1.3	1.2	1.3	2.7	2.7	2.7	2.9	2.6	2.6	2.3	1.2	1.1
22	1.3	1.3	1.3	2.7	2.7	2.7	2.7	2.4	1.2	2.3	1.2	1.1
23	1.3	1.3	1.3	2.7	2.7	2.7	2.6	2.4	1.2	2.3	1.2	1.1
24	1.3	1.4	1.3	2.6	2.7	2.7	2.6	2.4	.....	2.3	1.2	1.1
25	1.2	1.4	1.3	2.6	2.7	2.7	2.6	2.35	.....	2.3	1.2	1.1
26	1.2	1.4	1.3	2.7	2.7	2.7	2.6	2.4	.....	2.2	1.2	1.1
27	1.2	1.4	1.3	2.7	2.7	2.7	2.6	2.4	.....	2.2	.75	1.1
28	1.2	1.4	1.3	2.7	2.7	2.7	2.7	2.35	.....	2.2	.75	1.1
29	1.7	.....	1.3	2.7	2.7	2.7	1.8	2.4	1.3	2.2	.75	1.1
30	1.2	.....	1.3	2.7	2.7	2.7	1.8	2.4	1.2	2.2	.75	1.1
31	1.2	.....	1.3	.....	2.7	.....	1.8	2.4	.....	2.3	.....	1.1

Daily discharge, in second-feet, of Hanamaulu ditch near Lihue, Kauai, for 1910–11.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	40	46	46	46	.....	14	16	43	46	46	46	.....	10
2	40	46	46	46	34	10	17	43	46	46	46	.....	10
3	40	46	46	46	.....	10	18	46	46	46	46	.....	10
4	42	48	46	46	.....	10	19	46	46	46	46	.....	10
5	38	46	46	46	.....	10	20	46	46	46	49	14	10
6	38	46	46	46	.....	10	21	46	49	46	49	14	34
7	43	46	46	46	.....	10	22	46	46	46	46	14	34
8	43	46	46	46	.....	10	23	46	46	46	46	14	37
9	43	46	46	43	.....	10	24	46	46	46	46	14	37
10	43	46	46	43	.....	10	25	46	46	46	46	14	31
11	43	46	43	43	.....	10	26	46	46	46	46	16	10
12	44	46	46	43	.....	10	27	46	46	46	46	14	10
13	43	46	46	46	.....	10	28	46	46	49	46	14	10
14	43	46	46	46	.....	10	29	46	46	46	.....	18	49
15	43	46	46	46	.....	10	30	46	46	46	.....	14	10
							31	43	46	.....	.....	.....	20

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	8.0	10	14	12	49	49	49	23	40	19	39	5.6
2	8.0	10	14	12	49	49	49	23	40	19	39	.....
3	8.0	10	14	12	49	49	49	23	40	19	39	5.6
4	8.0	10	14	12	49	49	49	23	40	19	39	5.6
5	8.0	10	14	12	46	49	46	23	40	19	39	5.6
6	8.0	10	14	12	46	49	49	23	42	19	42	6.9
7	8.0	10	14	12	46	49	46	23	40	19	42	6.9
8	8.0	10	11	37	46	49	46	49	40	19	42	6.9
9	8.0	10	11	37	46	49	46	49	40	19	42	6.9
10	8.0	10	11	37	46	49	49	37	40	19	42	6.9
11	8.0	10	11	37	46	49	49	37	43	19	42	6.9
12	8.0	10	11	37	49	49	49	37	46	27	42	6.9
13	12	10	11	49	46	49	49	40	43	27	42	6.9
14	12	10	24	43	46	49	49	37	46	27	44	6.9
15	12	10	24	43	46	49	49	37	46	27	44	6.9
16	12	10	24	49	46	49	49	40	43	27	42	11
17	12	10	24	49	46	49	46	40	43	27	42	11
18	12	10	24	49	46	49	46	40	40	42	24	11
19	12	10	16	49	46	49	49	46	40	42	24	11
20	12	10	12	49	46	46	49	46	43	42	15	11
21	12	10	12	49	49	49	55	46	46	42	13	11
22	12	12	12	49	49	49	49	40	10	42	13	11
23	12	12	12	49	49	49	46	40	10	42	13	11
24	12	14	12	46	49	49	46	40	.....	42	13	11
25	10	14	12	46	49	49	46	38	.....	42	13	11
26	10	14	12	49	49	49	46	40	.....	39	13	11
27	10	14	12	49	49	49	46	40	.....	39	5.6	11
28	10	14	12	49	49	49	49	38	.....	39	5.6	11
29	20	.....	12	49	49	49	23	40	12	39	5.6	11
30	10	.....	12	49	49	49	23	40	10	39	5.6	11
31	10	.....	12	.....	49	.....	23	40	.....	42	.....	11

NOTE.—Daily discharge computed from two fairly well defined rating curves, covering the periods July 1, 1910, to Sept. 30, 1911, and Oct. 1 to Dec. 31, 1911, respectively.
Ditch dry on days for which no discharge is given.

Monthly discharge of Hanamaulu ditch near Lihue, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
July	46	38	43.6	2,680	B.
August	49	46	46.2	2,840	B.
September	49	43	46.0	2,740	B.
October 1–28	49	43	45.8	2,550	B.
November 2 and 20–30	34	14	16.2	385	B.
December	49	10	15.7	965	B.
The period				12,200	
1911.					
January	20	8	10.3	633	B.
February	14	10	10.9	605	B.
March	24	11	14.3	879	B.
April	49	12	37.8	2,250	B.
May	49	46	47.5	2,920	B.
June	49	46	48.9	2,910	B.
July	55	23	45.6	2,800	B.
August	49	23	36.7	2,260	B.
September 1–23 and 29–30	46	10	36.9	1,830	B.
October	42	19	30.5	1,880	C.
November	44	5.6	28.9	1,720	C.
December 1 and 3–31	11	5.6	8.91	531	B.
The period	55	5.6	29.8	21,200	

NOTE.—Minimum and mean discharges are only for days when ditch was carrying water. The ditch was dry during the periods Oct. 29 to Nov. 1 and Nov. 3–19, 1910; Sept. 24–28 and Dec. 2, 1911.

NORTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

A gaging station was established on North Fork of Wailua River just below the junction of the main branches about half a mile below the power line of the Kauai Electric Co., August 1, 1910. The station is about a mile below the intake of Kanaha ditch, which diverts water from the south side. This station was destroyed by flood October 28, 1910.

The station on North Fork was reestablished December 28, 1910, about 100 feet below the old station. Gage heights are obtained by means of a Friez clock register on the right bank. Measurements are made from a wire suspension bridge.

The stream is 30 feet wide at low water and has an extreme range of stage of 10 to 12 feet. (See fig. 2.)

This station is just inside the Forest Reserve fence, about 2 miles above Kaholalele Falls, and 8 or 9 miles northwest of Lihue.

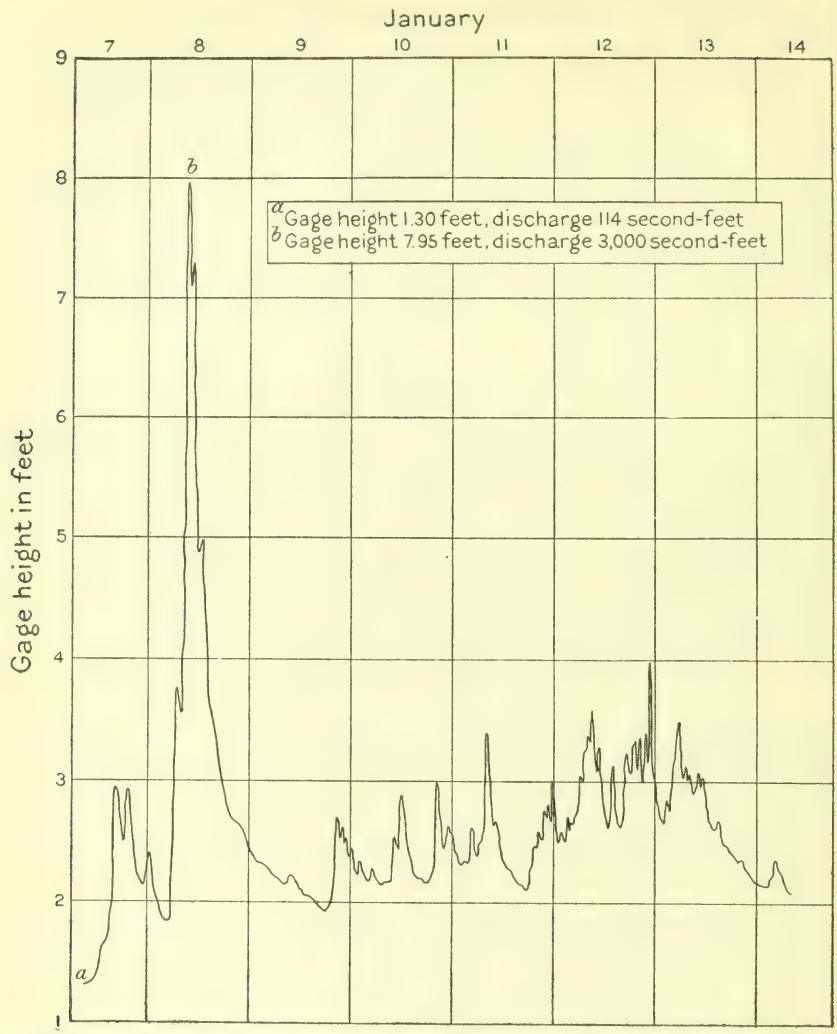


FIGURE 2.—Diagram showing fluctuation in stage of North Fork of Wailua River near Lihue, Kauai.

Discharge measurements of North Fork of Wailua River near Lihue, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 31[a]	A. G. Schnach	31	79	[b] 2.50	69
Aug. 2[a]	....do	31.5	82	[b] 2.15	42.0
Oct. 1[a]	Martin and Pierce	31	92	[b] 2.60	91
Dec. 30[c]	Martin and Mendes	68	238	[b] 2.48	409
1911.					
Feb. 8[d]	Martin and Hoyt	62	201	[d] 2.05	271
Sept. 5[a]	W. V. Hardy	18	26.5	[d] 0.70	38.4
Oct. 16[d]	....do	39.5	146	[d] 1.32	122

[a] Measurement made by wading.
[b] Old station. This gage was destroyed by high water Oct. 28, 1910.
[c] New station established Dec. 23, 1910. This gage is about 100 feet below the old gage, and at a different datum.
[d] Measurement made from new footbridge.

NOTE.—Additional measurements made early in 1912, were used in determining the rating.

Daily gage height, in feet, of North Fork of Wailua River near Lihue, Kauai, for 1910–11.

[Mori, observer.]

Day.	Aug.	Sept.	Oct.	Dec.	Day.	Aug.	Sept.	Oct.	Dec.
1910.					1910.				
1	.....	2.15	2.55	.....	16	2.25	2.25	2.6	.....
2	.....	2.2	2.4	.....	17	2.15	2.3	2.5	.....
3	.....	2.1	2.35	.....	18	2.1	2.6	2.4	.....
4	.....	2.35	2.6	.....	19	2.15	3.15	2.45	.....
5	.....	2.1	2.35	.....	20	3.05	2.75	2.3	.....
6	2.8	2.1	2.3	.....	21	4.05	3.2	2.4	.....
7	2.5	2.15	2.25	.....	22	2.8	3.9	.....	.....
8	2.5	2.05	2.8	.....	23	2.4	3.1	.....	.....
9	2.75	2.2	2.7	.....	24	2.3	3.3	.....	.....
10	2.45	2.0	2.45	.....	25	3.9	2.55	.....	.....
11	2.35	2.3	2.55	.....	26	3.0	2.65	.....	.....
12	2.3	2.5	3.3	.....	27	2.7	2.7	.....	.....
13	2.2	2.7	5.25	.....	28	2.4	3.15	.....	1.5
14	2.4	2.25	3.2	.....	29	2.4	2.4	.....	1.4
15	2.55	2.45	2.8	.....	30	2.25	2.5	.....	2.2
					31	2.15	.....	.....	1.5

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.4	2.8	1.35	1.1	1.35	1.6	1.3	1.0	.6	1.7	.7	1.1
2	1.2	2.3	1.3	1.1	1.3	1.65	1.3	.95	.6	1.55	.7	1.05
3	1.5	2.0	1.65	.95	1.4	1.7	1.3	.95	.6	1.85	.75	1.1
4	1.3	2.3	1.3	.9	1.35	.....	1.2	.9	.6	1.8	.85	1.2
5	1.3	2.05	1.15	.9	1.35	.....	1.1	.9	.75	1.45	.95	1.15
6	2.1	3.6	1.1	.85	1.3	.....	1.0	.85	.7	1.35	.9	1.55
7	2.05	2.35	1.15	.85	1.35	.....	.9	.85	.65	1.35	.9	1.25
8	3.7	2.1	1.45	.85	1.6	.....	.9	.85	.6	1.3	.95	1.8
9	2.25	2.1	1.2	.8	1.7	.....	.9	.95	.65	1.25	1.15	3.0
10	2.4	2.3	1.15	.8	1.45	.....	.85	.9	1.05	1.15	1.0	.....
11	2.55	2.1	1.1	.8	1.45	1.15	.8	.9	1.5	1.1	1.2	.....
12	3.0	2.0	1.15	.9	1.35	1.1	.75	1.55	1.4	1.05	.95	.....
13	2.75	1.8	1.0	.75	.9	1.9	.75	1.1	.8	.95	1.3	.....
14	2.1	1.65	.9	.8	.95	1.75	.7	1.5	1.35	.95	1.65	.....
15	1.9	1.55	.9	.8	.95	1.4	.9	1.05	1.0	.95	1.5	.....
16	1.75	1.5	.9	.8	1.1	1.15	.9	.95	1.2	.95	1.25	.....
17	4.5	1.45	.95	.8	1.05	1.2	.95	1.15	1.7	.95	1.35	1.25
18	4.45	1.4	.85	.9	.95	1.05	.8	1.25	1.9	.95	1.6	1.15
19	4.4	1.35	.85	.95	.95	1.05	.85	1.3	1.2	.95	1.5	1.15
20	3.2	1.4	.85	1.0	.95	1.1	.95	1.4	2.3	.95	1.2	1.1
21	1.5	1.35	1.05	1.1	1.75	1.4	1.0	1.0	3.75	.95	1.15	1.0
22	1.55	1.3	1.5	1.5	2.3	1.15	.9	.9	2.5	.9	1.15	1.4
23	1.5	1.45	1.3	1.5	2.1	1.35	.9	.9	2.6	.....	1.0	1.2
24	2.2	1.35	1.2	1.5	.8	1.15	.85	.85	4.1	.....	1.25	1.05
25	2.8	1.25	2.85	1.45	.7	1.15	.85	.85	2.35	.....	1.2	1.0
26	2.0	2.2	3.0	1.3	1.4	.....	.85	.85	2.8	.....	1.15	.85
27	2.65	1.9	1.7	2.45	1.4	.....	1.95	.7	2.1	.....	1.35	.75
28	4.7	1.5	1.65	1.8	2.5	.....	1.8	.65	1.75	.....	1.2	1.2
29	2.4	.....	1.3	1.4	1.9	.....	1.3	.65	1.6	.....	1.15	1.7
30	2.0	.....	1.15	1.4	1.6	.....	1.1	.65	1.75	.....	1.1	1.5
31	2.6	.....	1.1	.....	1.7	.....	1.05	.7	.....	.....	.....	.9

Daily discharge, in second-feet, of North Fork of Wailua River near Lihue, Kauai, for 1910–11.

Day.	Aug.	Sept.	Oct.	Dec.	Day.	Aug.	Sept.	Oct.	Dec.
1910.					1910.				
1	.....	38	82	.....	16	47	47	88	.....
2	.....	42	63	.....	17	38	52	75	.....
3	.....	33	58	.....	18	33	88	63	.....
4	.....	58	95	.....	19	38	185	69	.....
5	.....	33	58	.....	20	164	110	52	.....
6	117	33	52	.....	21	437	196	63	.....
7	75	38	47	.....	22	117	386	.....	.....
8	75	29	117	.....	23	63	174	.....	.....
9	110	42	102	.....	24	52	219	.....	.....
10	69	25	69	.....	25	386	82	.....	.....
11	58	52	81	.....	26	153	95	.....	.....
12	52	75	219	.....	27	102	102	.....	.....
13	42	102	925	.....	28	63	185	.....	147
14	63	47	196	.....	29	63	63	.....	130
15	81	69	117	.....	30	47	75	.....	317
					31	38	.....	.....	147

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	130	515	122	85	122	166	114	72	30	187	39	85
2	99	347	114	85	114	176	114	66	30	156	39	78
3	147	260	176	66	130	187	114	66	30	222	44	85
4	114	347	114	60	122	114	99	60	30	210	54	99
5	114	274	92	60	122	147	85	60	44	138	66	92
6	288	844	85	54	114	234	72	54	39	122	60	156
7	274	362	92	54	122	260	60	54	34	122	60	106
8	888	288	138	54	166	85	60	54	30	114	66	210
9	332	288	99	49	187	497	60	66	34	106	92	590
10	378	347	92	49	138	92	54	60	78	92	72	410
11	427	288	85	49	138	92	49	60	147	85	99	187
12	590	260	92	60	122	85	44	156	130	78	66	444
13	497	210	72	44	60	234	44	85	49	66	114	166
14	288	176	60	49	66	198	39	147	122	66	176	166
15	234	156	60	49	66	130	60	78	72	66	147	147
16	198	147	60	49	85	92	60	66	99	66	106	210
17	1,250	138	66	49	78	99	66	92	187	66	122	106
18	1,220	130	54	60	66	78	49	106	234	66	166	92
19	1,200	122	54	66	66	78	54	114	99	66	147	92
20	672	130	54	72	66	85	66	130	347	66	99	85
21	147	122	78	85	198	130	72	72	910	66	92	72
22	156	114	147	147	347	92	60	60	410	60	92	130
23	147	138	114	147	288	122	60	60	444	54	72	99
24	317	122	99	147	49	92	54	54	1,070	49	106	78
25	515	106	534	138	39	92	54	54	362	44	99	72
26	260	317	590	114	130	66	54	54	515	39	92	54
27	462	234	187	394	130	49	247	39	288	34	122	44
28	1,340	147	176	210	410	66	210	34	198	30	99	99
29	378	.....	114	130	234	99	114	34	166	34	92	187
30	260	.....	92	130	166	106	85	34	198	34	85	147
31	444	.....	85	.....	187	.....	78	39	.....	39	.....	60

NOTE.—Daily discharge computed from a rating curve poorly defined from Aug. 6 to Oct. 21, 1910, and from a curve well defined below 500 second-feet after Dec. 28, 1910. No record of flow from Oct. 22 to Dec. 27, 1910, inclusive, on account of destruction of the station. Discharge estimated by comparison with South Fork of Wailua River, as follows: June 4 to 10 and 26 to 30; Oct. 23 to Nov. 3; Dec. 10 to 16, 1911. The table does not include the water diverted by Kanaha ditch above the station.

Monthly discharge of North Fork of Wailua River near Lihue, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
August 6–31	437	33	99.2	5,120	C.
September	386	25	92.8	5,520	C.
October 1–21	925	47	128	5,330	C.
1911.					
January	1,340	99	444	27,300	A.
February	844	106	248	13,800	A.
March	590	54	129	7,930	A.
April	394	44	93.7	5,580	A.
May	410	39	140	8,610	A.
June	497	49	134	7,970	C.
July	247	39	79.2	4,870	A.
August	156	34	70.2	4,320	A.
September	1,070	30	215	12,800	B.
October	222	30	85.4	5,250	C.
November	176	39	92.6	5,510	B.
December	590	44	150	9,220	C.
The year	1,340	30	156	113,000	

NOTE.—The above estimate does not include the flow of Kanaha ditch.

KANAHA DITCH NEAR LIHUE, KAUAI.

Kanaha ditch diverts water from the south side of North Fork of Wailua River, about 1 mile above the gaging station on the river and 9 or 10 miles northwest of Lihue. This ditch furnishes water for the cane lands between the North and South Forks, and then crosses the South Fork and unites with the Lihue ditch from the South Fork.

A gaging station was established on Kanaha ditch August 1, 1910, in the open ditch a few hundred feet below the intake. The gage is on the right bank. Measurements are made in the flume about 200 feet above the gage.

The record at this station shows how much water is taken from North Fork above the river gaging station for irrigating cane by the Lihue Plantation Co.

Discharge measurements of Kanaha ditch near Lihue, Kauai, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 31	A. G. Schhack	6.0	16.0	3.40	35.8
Aug. 2	....do	7.0	18.0	3.25	37.5
31	....do	4.5	11.6	a 3.4	34.3
Oct. 1	Martin and Pierce	4.5	12.0	3.49	34.2

a May be in error. Taken from gage-height book for this date.

NOTE.—Measurements made at various sections.

Daily gage height, in feet, of Kanaha ditch near Lihue, Kauai, for 1910–11.

[Mori, observer.]

Day.	Aug.	Sept.	Oct.	Nov	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.						1910.					
1	.....	3.4	3.6	2.7	0	16	3.5	3.5	3.6	0	1.2
2	.....	3.4	3.6	0	0	17	3.5	3.5	3.5	0	1.2
3	.....	3.4	3.6	0	0	18	3.4	3.5	3.6	0	1.2
4	.....	3.5	3.6	0	0	19	3.4	3.5	3.6	0	1.2
5	.....	3.4	3.6	0	0	20	3.5	3.5	3.6	0	1.2
6	3.3	3.5	3.6	0	0	21	3.5	3.4	3.6	0	2.1
7	3.4	3.5	3.6	0	0	22	3.5	3.5	3.6	0	2.5
8	3.5	3.5	3.6	0	0	23	3.5	3.5	3.6	0	2.9
9	3.5	3.5	3.6	0	0	24	3.4	3.5	3.6	0	2.9
10	3.5	3.5	3.6	0	0	25	3.4	3.4	3.6	0	2.1
11	3.5	3.5	3.5	0	0	26	3.5	3.4	3.6	0	2.2
12	3.5	3.5	3.6	0	0	27	3.5	3.4	3.7	0	2.1
13	3.4	3.5	3.7	0	0	28	3.4	3.5	3.7	0	2.8
14	3.5	3.5	3.6	0	0	29	3.5	3.4	3.4	0	2.8
15	3.5	3.5	3.6	0	1.2	30	3.5	3.4	3.4	0	2.8
						31	3.4	.....	3.4	.....	2.8

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	2.8	0	1.5	2.0	2.9	3.0	2.9	1.2	2.9	1.2	2.75	1.6
2	2.8	0	1.5	2.0	2.9	3.0	3.0	2.4	2.8	1.2	2.75	1.5
3	2.8	0	1.5	2.4	2.9	3.0	3.0	2.4	2.8	1.2	2.7	1.5
4	2.5	0	1.5	2.4	2.9	3.0	3.0	2.4	2.8	1.2	2.85	1.5
5	2.5	0	1.5	2.4	2.8	3.0	2.8	2.4	3.0	1.2	2.85	1.5
6	2.4	0	1.5	2.4	2.8	3.0	2.8	2.4	3.0	1.2	2.9	1.6
7	2.4	0	1.5	2.4	2.9	3.0	2.9	2.4	3.0	1.2	2.9	1.5
8	1.2	0	1.5	2.4	2.9	3.0	2.9	2.8	3.0	1.2	2.9	1.4
9	1.0	0	1.5	2.4	2.9	3.0	2.9	2.8	3.1	1.2	2.9	1.4
10	1.0	0	1.5	2.4	2.9	3.0	3.0	3.0	3.15	1.2	2.9	1.4
11	1.0	0	1.5	2.6	2.9	3.0	3.0	3.0	3.2	2.2	3.1	1.4
12	1.0	0	1.5	2.6	2.9	3.0	3.0	3.0	3.0	2.2	3.0	1.4
13	0	0	2.7	2.6	2.8	3.0	3.0	3.1	3.0	2.2	3.0	1.4
14	0	0	2.7	2.6	2.9	3.1	2.9	3.0	3.0	2.2	3.1	1.6
15	0	0	2.7	2.7	2.9	3.0	2.9	3.0	3.1	2.8	3.1	1.6
16	0	0	2.7	2.7	2.9	2.95	2.9	2.8	3.0	2.8	3.0	1.6
17	0	0	2.7	2.7	2.9	3.0	2.8	2.85	3.1	2.8	3.0	1.5
18	0	0	2.7	2.7	2.8	3.0	2.8	2.8	3.0	2.8	3.1	1.5
19	0	0	2.7	2.7	2.9	2.9	3.0	2.8	3.0	2.8	3.0	1.5
20	0	0	2.7	2.7	2.9	2.9	2.9	3.0	3.2	2.65	3.0	1.5
21	0	1.5	2.7	2.9	2.9	3.1	2.9	2.9	3.1	2.65	2.3	2.3
22	0	1.5	2.0	2.8	3.0	3.0	2.9	2.8	3.0	2.6	2.5	0
23	0	1.5	2.0	2.8	3.0	3.0	2.85	2.8	2.9	2.8	2.5	0
24	0	1.5	2.0	2.7	3.0	3.0	2.8	2.75	2.1	2.85	2.5	0
25	0	1.5	2.0	2.9	2.9	3.0	2.8	2.8	1.2	2.9	2.5	0
26	0	1.5	2.0	2.9	2.9	3.0	2.75	2.8	1.2	2.8	2.5	0
27	0	1.5	2.0	2.9	2.9	3.0	2.7	2.75	1.2	2.85	2.5	2.5
28	0	1.5	2.0	2.9	3.0	3.0	3.1	2.8	1.2	2.8	1.6	2.5
29	0	.....	2.0	2.9	3.0	3.0	1.2	2.8	1.2	2.8	1.6	2.55
30	0	.....	2.0	2.9	3.0	3.0	1.2	3.0	1.2	2.85	1.6	2.5
31	0	.....	2.0	.....	3.0	.....	1.2	3.0	.....	3.0	.....	2.5

NOTE.—Discharge to be published later when sufficient measurements for a rating have been made.

KONOHIKI AND KAEHULUA BASINS.

WEIR STATIONS NEAR KAPAA.

Konohiki and Kaehulua streams, in order from south to north, drain two small basins north of Opaikaa-Wailua basin and south of the Kapaa lands. The basins are on the fee-simple lands of Olohena and Waipouli and reach back 5 or 6 miles from the sea. The Kae-

hulua basin on the north appears the larger of the two. Both areas are comparatively open and rolling in character.

The Makee Sugar Co. has kept records of discharge over 3-foot weirs on Konohiki and Kaehulua streams, and has furnished the records that the Geological Survey has used to compute the daily flow.

Makakualele weir is on the upper part of Konohiki Stream. Kainahola and Wainamuamu weirs are on different branches of Kaehulua Stream, and Kuhinoa (mule stable) weir is on the main stream below the junction of the branches.

Discharge measurements of Makakualele weir near Kapaa, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 29	W. V. Hardy	2.3	0.73	[a] 0.20	0.71

[a] Head on 3-foot weir.

Daily discharge, in second-feet, of Makakualele weir near Kapaa, Kauai, for April–December, 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.0	1.6	1.3	1.1	0.9	1.8	1.2	1.2
2	3.0	2.0	1.6	1.2	1.1	.9	2.9	1.2	1.1
3	3.0	2.0	2.1	1.2	1.0	.9	2.2	1.2	1.1
4	2.9	1.9	1.6	1.2	1.0	.9	2.0	1.2	1.2
5	2.9	1.9	1.6	1.2	1.0	.9	1.8	1.2	1.1
6	2.9	1.9	1.6	1.3	1.0	.9	1.8	1.1	1.2
7	2.9	2.2	1.6	1.2	1.0	.9	1.6	1.1	1.1
8	2.8	1.9	1.8	1.2	1.0	.8	1.6	1.1	1.2
9	2.7	1.9	1.6	1.2	1.0	.8	1.6	1.1	1.2
10	2.6	2.0	1.6	1.2	1.0	.8	1.6	1.0	1.2
11	2.6	2.1	1.6	1.2	1.0	.9	1.5	1.0	1.4
12	2.6	1.9	1.5	1.2	1.2	.9	1.5	1.0	1.2
13	2.5	1.9	1.8	1.2	1.1	.9	1.5	1.0	1.1
14	2.5	1.9	1.6	1.2	1.0	.9	1.5	1.1	1.2
15	2.5	1.9	1.5	1.2	1.3	.9	1.4	1.1	1.1
16	2.5	2.2	1.5	1.2	1.0	.9	1.4	1.1	1.1
17	2.6	2.0	1.5	1.2	1.0	1.0	1.4	1.1	1.1
18	2.6	1.9	1.4	1.2	1.0	1.0	1.4	1.2	1.2
19	2.5	1.9	1.5	1.1	1.0	.9	1.4	1.2	1.2
20	2.5	1.8	1.4	1.1	1.0	.9	1.3	1.1	1.1
21	2.5	1.8	1.6	1.1	1.0	5.7	1.4	1.1	1.1
22	2.4	1.8	1.4	1.2	1.0	2.7	1.3	1.1	1.3
23	2.5	1.8	1.4	1.1	1.0	1.5	1.3	1.1	1.2
24	2.5	1.8	1.4	1.2	1.0	2.5	1.3	1.0	1.2
25	2.4	1.8	1.4	1.1	.9	3.0	1.3	1.2	1.2
26	2.4	1.6	1.4	1.1	.9	2.7	1.3	1.2	1.1
27	2.3	2.4	1.4	1.3	.9	1.8	1.2	1.4	1.1
28	2.2	2.4	1.3	3.4	.9	1.8	1.2	1.3	1.1
29	2.2	2.0	1.6	1.4	.9	1.8	1.2	1.2	1.2
30	2.2	1.9	1.5	1.1	.9	1.8	1.2	1.2	1.2
31	.....	1.6	.....	1.1	.9	.....	1.2	.....	1.2

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in million gallons per 24 hours.

Monthly discharge of Makakualele weir near Kapaa, Kauai, for Apr. 1 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	3.0	2.2	2.57	153
May	2.4	1.6	1.94	119
June	2.1	1.3	1.55	92.2
July	3.4	1.1	1.26	77.5
August	1.3	.9	1.00	61.5
September	5.7	.8	1.44	85.7
October	2.9	1.2	1.52	93.5
November	1 4	1.0	1.14	67.8
December	1.4	1.1	1.17	71.9
The period				822

Daily discharge, in second-feet, of Kainahola weir near Kapaa, Kauai, for April–December, 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	0.8	1.0	0.8	0.8	0.7	0.9	0.7	0.7
2	1.2	.8	1.0	.8	.8	.7	.9	.7	.7
3	1.2	.8	1.2	.8	.7	.6	1.2	.7	.7
4	1.2	.8	1.1	.8	.7	.6	1.2	.7	.7
5	1.2	.8	.9	.8	.7	.6	1.1	.7	.7
6	1.2	.8	.8	.8	.7	.6	1.1	.7	.7
7	1.2	.8	.8	.8	.7	.6	1.0	.7	.7
8	1.2	.8	.8	.8	.7	.6	.9	.7	.7
9	1.2	.8	.8	.8	.7	.6	.9	.7	.7
10	1.1	1.0	.8	.8	.7	.7	.9	.7	.7
11	1.1	.9	.8	.8	.7	.7	.8	.7	.7
12	1.0	.9	.8	.8	.8	.7	.8	.7	.7
13	1.0	.8	.9	.8	.8	.7	.8	.7	.7
14	1.0	.8	.9	.8	.8	.7	.8	.7	.8
15	1.0	.8	.9	.8	.8	.8	.8	.7	.8
16	1.0	.8	.8	.8	.8	.6	.8	.7	.8
17	1.0	.8	.8	.8	.8	.6	.8	.7	.8
18	1.0	.8	.8	.8	.8	.6	.8	.7	.8
19	1.0	.8	.8	.8	.7	.6	.7	.7	.7
20	1.0	.8	.8	.7	.7	.6	.8	.7	.6
21	1.0	.8	.9	.7	.7	2.0	.8	.7	.7
22	1.0	.8	.9	.7	.7	2.7	.8	.7	.7
28	1.0	.9	.8	.7	.7	.9	.8	.7	.8
24	1.0	.9	.8	.7	.7	4.0	.8	.7	.8
25	1.0	.9	.8	.7	.7	1.6	.8	.8	.8
26	1.0	.9	.8	.7	.7	1.5	.8	.7	.8
27	1.0	.9	.8	1.0	.7	1.4	.8	.8	.7
28	.9	1.0	.8	1.4	.7	1.4	.8	.8	.7
29	.9	1.0	.8	.9	.7	1.0	.8	.8	1.0
30	.8	1.0	.8	1.0	.7	1.0	.8	.7	.8
31		1.0		.8	.7		.7		.8

NOTE.—The discharge in second-feet has been computed by the Geological Survey from records of daily discharge in million gallons per 24 hours.

Monthly discharge of Kainahola weir near Kapaa, Kauai, for Apr. 1 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	1.2	0.8	1.05	62.5
May	1.0	8	.85	52.3
June	1.2	.8	.86	51.2
July	1.4	.7	.81	49.8
August	.8	.7	.73	44.9
September	4.0	.6	1.01	60.1
October	1.2	.7	.86	52.9
November	.8	.7	.71	42.2
December	1.0	.6	.74	45.5
The period				461

Discharge measurements of Wainamuamu weir near Kapaa, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 29	W. V. Hardy	3.3	2.78	[a] 0.36	2.17

[a] Head on 3-foot weir.

Daily discharge, in second-feet, of Wainamuamu weir near Kapaa, Kauai, for April–December, 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.9	0.9	0.8	0.7	0.7	0.7	0.8	0.7	1.1
2	.9	.9	.8	.7	.6	.7	.8	.8	1.1
3	.9	.8	.9	.6	.6	.7	.8	.8	1.1
4	1.2	.8	.8	.6	.6	.6	.8	.8	1.2
5	1.2	.8	.8	.8	.6	.6	.7	.7	1.2
6	1.6	.8	.8	.7	.6	.6	.7	.6	1.3
7	1.1	.9	.8	.6	.6	.6	.7	.6	1.0
8	1.0	.8	.9	.6	.6	.6	.7	.6	1.0
9	.9	.8	.8	.6	.6	.6	.7	.6	1.0
10	.9	.9	.8	.7	.6	.6	.7	.6	1.1
11	.9	.9	.8	.6	.6	.6	.7	.6	1.3
12	.9	.8	.8	.6	.8	.6	.7	.6	1.2
13	.9	.8	.9	.6	.7	.6	.7	.6	1.2
14	.9	.8	.8	.7	.7	.6	.7	.6	1.4
15	.9	.8	.8	.6	.8	.6	.7	.6	1.3
16	.9	.9	.8	.6	.7	.6	.7	.6	1.3
17	.9	.8	.8	.6	.7	.6	.7	.6	1.3
18	.8	.8	.8	.6	.8	.6	.7	.8	1.4
19	1.0	.8	.8	.6	.7	.6	.7	.8	1.0
20	.8	.8	.8	.6	.7	.7	.7	.6	1.2
21	.8	.8	.8	.6	.7	.7	.7	.8	1.2
22	.8	.8	.8	.7	.7	.7	.7	.8	1.2
23	1.0	.8	.8	.6	.7	.8	.7	.6	1.3
24	.9	.8	.8	.9	.7	.8	.7	.6	1.3
25	1.0	.8	.8	.8	.7	.8	.7	.6	1.3
26	.9	.8	.8	.7	.7	.8	.7	.6	1.2
27	.9	.8	.8	.8	.7	.8	.7	.6	.9
28	.9	.8	.7	1.1	.7	.7	.7	.6	.6
29	.9	1.6	.9	.8	.7	.7	.7	.6	.8
30	.9	1.2	.8	.7	.7	.7	.7	1.1	.6
31	.....	1.2	.....	.7	.7	.....	.7	.....	.....

NOTE.—Discharge in second-feet computed by the Geological Survey from records of daily discharge in million gallons per 24 hours.

Monthly discharge of Wainamuamu weir near Kapaa, Kauai, for Apr. 1 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	1.6	0.8	0.95	56.5
May	1.6	.8	.87	53.5
June	.9	.7	.81	48.2
July	1.1	.6	.68	41.8
August	.8	.6	.68	41.8
September	.8	.6	.66	39.3
October	.8	.7	.71	43.7
November	1.1	.6	.67	39.9
December	1.4	.6	1.10	67.6
The period				432

Discharge measurements of Kuhinoa weir near Kapaa, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 29	W. V. Hardy	2.5	8.2	[a] 0.415	6.4

[a] Head on 3-foot weir.

Daily discharge, in second-feet, of Kuhinoa weir near Kapaa, Kauai, for May–December, 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.5	1.2	0.7	1.1	3.2	5.3	1.2	1.8
2	.4	1.7	1.1	1.2	3.0	7.9	1.5	2.2
3	.4	3.6	1.7	2.0	3.9	5.9	1.4	2.2
4	.6	4.1	1.2	1.8	3.9	5.3	2.0	2.2
5	.7	1.2	1.0	1.7	4.5	3.9	1.2	.8
6	1.1	.8	.6	1.8	2.0	5.9	1.8	1.2
7	1.0	1.0	.8	1.2	1.5	5.9	2.0	2.7
8	.7	1.8	2.2	1.6	1.4	4.9	1.7	1.5
9	.6	.9	1.0	2.2	1.2	5.7	1.7	1.8
10	1.2	.9	2.1	1.2	4.1	4.5	2.1	1.4
11	1.5	1.0	1.8	1.2	1.8	2.4	2.4	1.2
12	1.1	.7	2.0	1.5	1.2	2.9	2.4	1.4
13	.7	1.0	2.0	1.8	1.0	2.7	1.5	1.2
14	.6	1.8	2.1	1.5	1.0	3.4	2.6	1.2
15	.5	1.0	1.8	12.0	.8	3.9	2.2	1.2
16	1.5	1.1	1.5	2.1	2.0	2.0	2.0	.7
17	1.4	.9	1.7	2.0	2.2	1.4	3.6	1.1
18	1.0	1.5	1.7	1.4	2.1	1.4	1.7	1.4
19	1.2	.9	2.0	2.1	2.2	1.7	1.2	.9
20	1.1	1.1	2.0	2.0	1.8	1.8	2.2	.9
21	1.4	.8	2.4	2.7	18.0	2.0	2.4	.9
22	1.1	.7	2.0	.9	12.2	3.0	2.4	1.2
23	1.2	1.4	2.0	1.4	8.1	2.7	3.0	1.2
24	1.1	1.5	2.1	1.7	13.0	2.0	2.2	1.4
25	1.2	1.8	3.0	1.5	8.4	2.0	2.0	1.7
26	1.4	1.5	1.4	2.0	9.8	1.4	2.0	2.9
27	1.4	1.5	1.8	1.7	5.3	1.7	4.5	1.0
28	1.2	1.1	9.8	1.7	4.7	1.2	3.4	1.2
29	1.2	1.8	4.5	4.1	3.0	1.8	3.9	1.4
30	1.1	1.1	4.5	2.2	3.6	1.2	2.0	1.2
31	1.4	.....	3.4	2.7	.....	1.4	.....	1.4

NOTE.—Discharge in second-feet computed by the Geological Survey from records of daily discharge in million gallons per 24 hours.

Monthly discharge of Kuhinoa weir near Kapaa, Kauai, for May 1 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May	1.5	0.4	1.02	62.7
June	4.1	.7	1.38	82.1
July	9.8	.6	2.19	135
August	12	.9	2.13	131
September	18	.8	4.36	259
October	7.9	1.2	3.20	197
November	4.5	1.2	2.21	132
December	2.9	.7	1.44	88.5
The period	.....	.....	.....	1,090

KAPAA RIVER BASIN.

GENERAL FEATURES.

The Kapaa River basin lies on the eastern slope of Kauai. It is roughly rectangular in shape, and approximately 18 square miles in area. It reaches back 7 or 8 miles from the ocean to the peaks of Puu Eu (elevation 2,748 feet) and Kapehuaala (elevation 3,130 feet). It lies north of Kaehulua basin in Waipouli, east of upper Wailua and Kalihiwai basins, and south of Anahola basin. The greater part of the basin consists of comparatively open rolling country.

The main stream is formed by two important branches which drain approximately equal areas and unite 2 or 3 miles from the sea. The south branch is on public land, and is called Kapaa Stream. The north branch is on fee simple land, and is called Kealia Stream. The term Kapaa River seems to be properly applied to only the main stream below the junction of the two branches.

The rainfall in the Kapaa basin ranges from 40 inches at sea level to 60 inches at elevation 500 feet, and possibly 300 inches or more at its head.

Water is diverted from the south side of Kapaa Stream at elevation 400 feet for cane irrigation, and from Kealia Stream at elevation 870 feet for power and irrigation.

Gaging stations have been established on Kapaa Stream and Kapahi ditch diverting water from it; also on Kaneha ditch, diverting water from Kealia Stream.

KAPAA RIVER AT KAPAHI, NEAR KAPAA, KAUAI.

A gaging station was established on Kapaa Stream July 23, 1910, at a point about half a mile above the intake of Kapaa ditch and about 4 miles west of Kealia.

A staff gage, located on the left bank of the stream and graduated to tenths of feet, is used for obtaining gage heights. Measurements are made at high water from a small wire bridge which spans the stream a few feet below the gage. Low-water measurements are made by wading.

The width of the stream is ordinarily about 16 feet, and the range of stage is probably as much as 10 or 12 feet.

The Makee Sugar Co. cooperates in maintaining this station to the extent of having its ditchman read the gage twice daily.

The records show the total discharge above all diversions.

Discharge measurements of Kapaa River at Kapahi, near Kapaa, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 13	A. G. Schnack	16.0	36.4	1.73	22.8
16	do	16.0	34.8	1.63	17.7
23	do	16.0	34.5	1.62	18.3
Nov. 19	W. F. Martin	19.3	30.3	1.74	25.7
1911.					
May 5	W. F. Martin	16.2	27.4	1.62	19.8
July 22	Martin and Hardy	15.0	26.1	1.70	19.7
Aug. 11	W. V. Hardy	15.0	29.2	1.70	21.3
Dec. 21	do	15.5	26.8	1.60	17.5
22	do	17.0	47.8	2.66	92.0

NOTE.—An additional measurement made early in 1912 was used in determining the rating. Measurements made at various sections.

Daily gage height, in feet, of Kapaa River at Kapahi, near Kapaa, Kauai, for 1910–11.

[S. Okimoto, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1		1.60	1.51	1.88	2.8	2.18	16		1.62	1.64	1.65	1.60	1.54
2		1.54	1.89	1.69	5.65	1.95	17		1.62	1.65	1.60	1.60	1.53
3		1.60	1.63	1.64	2.65	1.71	18		1.58	2.80	1.58	1.60	1.52
4		1.72	1.86	1.80	2.10	1.88	19		1.52	2.02	1.73	1.69	1.52
5		2.20	1.60	1.62	2.04	2.29	20		2.10	1.88	1.64	1.60	1.51
6		2.02	1.56	1.62	1.82	3.10	21		2.52	2.32	1.60	1.59	1.50
7		1.68	1.60	1.61	1.80	2.28	22		1.85	1.95	1.62	1.58	1.50
8		1.84	1.56	2.14	1.98	1.84	23	1.60	1.62	2.09	1.92	1.68	2.02
9		1.88	1.60	2.00	1.79	1.92	24	1.74	1.59	1.88	1.64	1.64	2.30
10		1.83	1.53	1.80	1.86	1.74	25	1.68	2.68	2.14	1.57	2.09	2.68
11		1.72	1.70	1.64	2.14	1.68	26	1.58	1.92	1.94	1.54	2.75	2.36
12		1.61	1.96	2.10	1.77	1.62	27	1.68	1.99	2.21	5.98	1.92	2.10
13		1.59	2.40	2.92	1.72	1.60	28	1.92	1.70	2.02	3.40	1.68	1.78
14		1.80	1.76	1.96	1.64	1.58	29	1.64	1.67	1.78	2.14	2.05	1.73
15		2.10	1.68	1.76	1.61	1.56	30	1.60	1.58	1.78	1.90	1.95	2.28
							31	1.58	1.52		1.79		1.74

Day.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.											
1	1.64	2.50	1.64	1.55	1.86	1.76	1.68	1.60	2.06	1.50	1.60
2	1.60	2.11	1.62	1.54	2.02	1.74	1.61	1.55	1.91	1.50	1.56
3	1.58	1.92	1.60	1.74	2.79	1.74	1.58	1.54	1.99	1.49	1.56
4	1.58	2.32	1.60	1.68	2.08	1.80	1.56	1.52	2.20	1.48	1.89
5	2.71	2.68	1.58	1.69	1.78	1.75	1.54	1.71	1.82	1.54	1.62
6	1.82	2.45	1.57	1.69	1.84	1.86	1.54	1.62	1.81	1.56	1.78
7	1.85	2.34	1.56	1.76	1.80	1.65	1.53	1.63	1.74	1.51	1.92
8	4.50	2.23	1.55	1.86	1.92	1.60	1.58	1.56	1.66	1.49	2.12
9	2.22	2.60	1.55	1.95	1.76	1.58	1.58	1.61	1.66	1.48	2.60
10	2.06	2.32	1.55	1.86	1.66	2.08	1.80	1.98	1.60	1.56	1.92
11	1.98	2.08	1.54	1.90	1.82	1.92	1.66	2.42	1.58	1.80	2.36
12	3.70	2.16	1.60	1.74	1.66	1.74	2.42	2.02	1.57	1.54	1.99
13	2.06	2.04	1.96	1.62	2.44	1.70	1.68	1.71	1.57	1.80	1.89
14	1.84	1.84	2.31	1.60	2.17	2.16	1.84	1.85	1.56	1.98	1.94
15	1.78	1.78	1.64	1.70	1.99	1.68	1.76	2.47	1.55	2.18	1.96
16	1.70	1.72	1.64	2.03	1.78	1.68	1.73	1.94	1.56	1.72	1.86
17	3.25	1.70	1.93	1.90	1.96	1.78	1.87	2.33	1.60	1.68	1.78
18	1.94	1.66	1.98	1.64	1.70	1.62	1.86	2.11	1.58	2.01	1.80
19	1.79	1.64	2.25	1.58	1.64	1.62	1.80	1.74	1.52	1.92	1.72
20	1.70	1.68	1.90	1.56	1.74	1.82	1.98	1.79	1.52	1.67	1.65
21	1.68	1.70	2.30	1.70	2.20	1.98	1.68	3.60	1.68	1.62	1.61
22	1.67	1.65	1.82	4.08	1.82	1.72	1.59	3.20	1.54	1.78	2.44
23	1.65	1.62	2.14	2.05	2.10	1.62	1.56	2.18	1.54	1.58	1.84
24	1.81	1.80	1.96	1.74	1.84	1.63	1.56	4.85	1.53	1.62	1.66
25	2.22	1.70	1.85	1.65	1.75	1.57	1.52	2.18	1.52	2.20	1.60
26	2.00	1.96	1.68	1.64	1.69	1.54	1.62	2.64	1.52	1.78	1.57
27	2.50	2.65	1.73	1.98	1.82	1.96	1.67	1.98	1.50	2.56	1.54
28	3.80	1.84	1.68	2.26	2.07	2.15	1.54	1.99	1.50	1.98	1.56
29	2.14	.....	1.62	2.09	2.42	1.88	1.53	1.88	1.58	1.77	2.38
30	1.89	.....	1.57	1.89	2.30	1.72	1.62	1.86	1.52	1.70	2.26
31	2.40	.....	.....	1.82	.....	1.62	1.82	.....	1.52	.....	1.79

Daily discharge, in second-feet, of Kapaa River at Kapahi, near Kapaa, Kauai, for 1910–11.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	.....	18	14	32	109	52	16	.....	18	20	20	18	16
2	.....	16	32	22	520	35	17	.....	18	20	18	18	16
3	.....	18	20	20	93	22	18	.....	18	109	18	18	14
4	.....	22	30	27	45	32	19	.....	14	38	24	22	14
5	.....	52	18	18	42	60	20	.....	45	32	20	18	14
6	.....	38	16	18	27	145	21	.....	78	60	18	18	14
7	.....	22	18	18	27	60	22	.....	30	35	18	18	14
8	.....	30	16	48	38	30	23	18	18	45	32	22	38
9	.....	32	18	38	27	32	24	24	18	32	20	20	60
10	.....	30	16	27	30	24	25	22	98	48	16	45	98
11	.....	22	22	20	48	22	26	18	32	35	16	104	64
12	.....	18	35	45	24	18	27	22	38	52	573	32	45
13	.....	18	69	121	22	18	28	32	22	38	184	22	27
14	.....	27	24	35	20	18	29	20	20	27	48	42	24
15	.....	45	22	24	18	16	30	18	18	27	32	35	60
							31	18	14	.....	27	.....	24

Day.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.											
1	20	78	20	16	30	24	22	18	42	14	18
2	18	45	18	16	38	24	18	16	32	14	16
3	18	32	18	24	109	24	18	16	38	14	16
4	18	60	18	22	45	27	16	14	52	14	32
5	98	98	18	22	27	24	16	22	27	16	18
6	27	74	16	22	30	30	16	18	27	16	27
7	30	64	16	24	27	20	16	20	24	14	32
8	348	56	16	30	32	18	18	16	20	14	45
9	52	88	16	35	24	18	18	18	20	14	88
10	42	60	16	30	20	45	27	38	18	16	32
11	38	45	16	32	27	32	20	69	18	27	64
12	228	48	18	24	20	24	69	38	16	16	38
13	42	42	35	18	74	22	22	22	16	27	32
14	30	30	60	18	48	48	30	30	16	38	35
15	27	27	20	22	38	22	24	74	16	52	35
16	22	22	20	42	27	22	24	35	16	22	30
17	164	22	35	32	35	27	30	64	18	22	27
18	35	20	38	20	22	18	30	45	18	38	27
19	27	20	56	18	20	18	27	25	14	32	22
20	22	22	32	16	24	27	38	27	14	20	20
21	22	22	60	22	52	38	22	213	22	18	18
22	20	20	27	288	27	22	18	158	16	27	74
23	20	18	48	42	45	18	16	52	16	18	30
24	27	27	35	24	30	20	16	400	16	18	20
25	52	22	30	20	24	16	14	52	14	52	18
26	38	35	22	20	22	16	18	93	14	27	16
27	78	93	24	38	27	35	20	38	14	83	16
28	243	30	22	56	42	48	16	38	14	38	16
29	48	.....	18	45	69	32	16	32	18	24	69
30	32	.....	16	32	60	22	18	30	14	22	56
31	69	.....	.....	27	.....	18	27	.....	14	.....	27

NOTE.—Daily discharge computed from a rating curve fairly well defined below 100 second-feet. It gives the total flow of the river above all diversions. No records were obtained during March, 1911.

Monthly discharge of Kapaa River at Kapahi, near Kapaa, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
July 23–31	32	18	21.3	380	B.
August	98	14	29.3	1,800	B.
September	109	14	32.9	1,960	B.
October	573	16	51.5	3,170	D.
November	520	18	51.4	3,060	D.
December	145	14	36.3	2,230	B.
The period					
1911.					
January	348	18	63.1	3,880	D.
February	98	18	43.6	2,420	B.
April	60	16	26.8	1,590	B.
May	288	16	35.4	2,180	C.
June	109	20	37.2	2,210	B.
July	48	16	25.8	1,590	B.
August	69	14	22.6	1,390	B.
September	400	14	57.7	3,430	D.
October	52	14	20.5	1,260	B.
November	83	14	25.6	1,520	B.
December	88	16	32.7	2,010	B.
The period				23,500	

AKULIKULI SPRINGS NEAR KAPAA, KAUAI.

Akulikuli Springs, so called, is a small stream tributary to the Kapaa Stream from the west a short distance below the intake of Kapaa ditch. It has a very uniform flow, which probably comes from springs.

In order to determine the minimum flow of this stream the water was diverted in the summer of 1909 and run over a 3-foot weir installed by the Territorial Public Works Department. This weir measures only the low and moderate flow of the stream, the freshet flow passing down the main channel.

The Makee Sugar Co. has kept a record on this weir since April 1, 1911, and has kindly furnished the results to the Geological Survey.

Discharge measurements of Akulikuli Springs near Kapaa, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 11	W. V. Hardy	3.0	2.25	[a] 0.35	2.52

[a] Head on 3-foot weir

NOTE.—Measurement made by wading about 250 feet below weir.

Daily discharge, in second-feet, of Akulikuli Springs near Kapaa, Kauai, for April-December, 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	2.3	2.4	2.3	2.3	2.1	1.5	2.0	1.9
2	1.8	2.3	2.4	2.3	2.2	2.0	1.5	2.0	1.9
3	2.4	2.3	2.6	2.3	2.2	2.0	1.6	2.0	1.9
4	2.4	2.3	2.4	2.3	2.2	2.0	1.8	2.0	1.9
5	2.4	2.3	2.4	2.2	2.2	2.0	1.6	1.9	1.9
6	2.3	2.3	2.4	2.2	2.2	2.0	1.5	1.9	1.9
7	2.3	2.3	2.4	2.2	2.1	2.0	1.5	1.9	1.9
8	2.3	2.3	2.4	2.2	2.1	2.0	1.5	1.9	2.1
9	2.3	2.3	2.4	2.2	2.1	2.0	1.5	1.9	2.1
10	2.3	2.3	2.4	2.2	2.1	2.1	1.5	1.9	2.1
11	2.3	2.3	2.4	2.2	2.1	2.1	1.5	1.9	2.1
12	2.3	2.3	2.4	2.2	2.1	2.2	1.5	1.9	2.2
13	2.3	2.3	2.6	2.2	2.2	2.1	1.5	1.9	2.2
14	2.4	2.3	2.5	2.2	2.2	2.1	1.5	1.9	2.2
15	2.4	2.3	2.4	2.2	2.2	2.6	1.5	2.1	2.2
16	2.4	2.3	2.4	2.2	2.2	2.3	2.0	2.0	2.2
17	2.4	2.3	2.4	2.2	2.2	2.2	2.0	2.0	2.2
18	2.4	2.3	2.4	2.1	2.2	2.2	2.0	2.0	2.1
19	2.4	2.3	2.4	2.1	2.3	2.2	2.0	2.0	2.0
20	2.4	2.3	2.3	2.1	2.4	2.2	2.0	2.0	2.2
21	2.4	2.3	2.7	2.1	2.4	2.2	2.0	2.0	2.1
22	2.4	2.3	2.7	2.1	2.3	2.2	2.4	2.0	2.1
23	2.4	2.2	2.3	2.1	2.2	2.0	2.0	2.0	2.1
24	2.4	2.2	2.3	2.2	2.2	2.2	2.0	1.9	2.1
25	2.4	2.3	2.3	2.2	2.2	2.0	2.0	2.5	2.0
26	2.4	2.3	2.3	2.2	2.2	2.0	2.0	2.5	2.0
27	2.4	2.3	2.3	2.4	2.2	2.0	2.0	1.4	2.0
28	2.4	2.4	2.3	3.0	2.1	1.8	2.0	1.2	2.0
29	2.4	3.2	2.5	2.5	2.1	1.6	2.0	1.2	2.5
30	2.3	2.9	2.7	2.4	2.1	1.5	2.0	1.2	2.3
31	.....	2.4	.....	2.4	2.1	.....	2.0	.....	2.3

NOTE.—Discharge in second-feet computed by the Geological Survey from records of discharge in million gallons per 24 hours.

Monthly discharge of Akulikuli Springs near Kapaa, Kauai, for Apr. 1–Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	2.4	1.8	2.33	139
May	3.2	2.2	2.35	144
June	2.7	2.3	2.43	145
July	3.0	2.1	2.25	138
August	2.4	2.1	2.19	135
September	2.6	1.5	2.06	123
October	2.4	1.5	1.79	110
November	2.5	1.2	1.90	113
December	2.5	1.9	2.09	129
The period	.....	.....	.....	1,180

KAPAHI DITCH AT KAPAHI, NEAR KAPAA, KAUAI.

Kapahi ditch diverts water from the south side of Kapaa stream at a point about 400 feet above sea level and about half a mile below the gaging station on the stream.

This ditch diverts all the ordinary flow of Kapaa stream and divides into three branch ditches a short distance below the intake.

A 20-foot weir was established on the main ditch about 600 feet below the intake April 15, 1909, by the Territorial Public Works Department. A Watson clock register is used for recording the head on the weir.

The Makee Sugar Co. cooperates in maintaining this station to the extent of having its ditchman attend to the clock register.

The record shows the total amount of water diverted from Kapaa stream through this ditch.

Discharge measurements of Kapahi ditch at Kapahi, near Kapaa, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	W. F. Martin	6.8	10.0	0.455	20.4
July 22	Martin and Hardy	6.9	14.4	.485	22.7
Aug. 14	W. V. Hardy	7.0	22.6	.575	31.8
Dec. 21	....do	6.7	3.8	.43	18.5

NOTE.—Measurements made at various sections. Gage heights are depth of water on crest of 20-foot weir.

Daily discharge, in second-feet, of Kapahi ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1					31	14	24	22	15	14	26	20
2					39	13	29	23	14	13	26	27
3					53	26	22	24	13	16	20	18
4					39	24	17	17	13	14	17	19
5					25	21	20	29	16	13	16	35
6					24	16	20	18	14	14	16	23
7					24	21	19	17	17	14	14	17
8					23	17	44	18	19	13	a14	14
9					26	14	28	16	19	12	a15	13
10					67	23	36	26	24	12	a15	14
11					42	17	28	20	24	12	a16	13
12					26	19	29	19	16	14	a17	12
13					29	17	20	19	15	15	a17	12
14					24	14	26	22	14	13	18	12
15				14	22	17	22	18	26	33	16	12
16				14	21	19	46	19	32	19	14	12
17				14	19	19	29	22	24	15	14	12
18				14	17	16	32	20	19	16	13	11
19				14	24	25	35	24	20	17	12	12
20				15	24	20	48	23	16	28	12	12
21				14	17	33	32	18	14	23	12	14
22				14	17	31	31	19	14	16	12	14
23				15	16	32	21	16	16	26	12	37
24				14	14	34	22	19	13	18	12	38
25				14	14	24	51	17	13	22	13	36
26				15	14	29	33	19	13	19	16	21
27				15	13	26	41	19	16	21	12	9.3
28				17	22	26	35	21	18	33	12	9.3
29				17	14	19	32	17	23	25	12	10
30				48	14	35	26	17	16	21	12	9.3
31					16		26	16	25	a24		9.3

a Discharge interpolated.

Daily discharge, in second-feet, of Kapahi ditch at Kapahi, near Kapaa, Kauai, for 1909–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	9	15	22	a21	14	31	19	14	19	17	23	40
2	9	15	22	a22	16	23	16	14	27	16	7.0	29
3	a12	14	22	24	14	24	16	14	17	19	4.7	21
4	a14	17	23	17	16	24	20	21	24	14	10	26
5	a16	20	22	16	14	22	17	36	16	15	13	29
6	a18	20	22	19	16	20	16	31	14	16	12	24
7	a20	16	22	18	21	18	15	18	13	25	19	17
8	a22	14	19	16	16	21	14	21	12	36	30	17
9	24	14	16	14	.....	23	13	21	14	41	26	17
10	25	19	14	13	.....	18	15	19	13	.....	15	17
11	25	24	13	.....	.....	18	14	17	18	.....	8.5	17
12	25	20	13	.....	.....	25	24	14	27	.....	8.3	.....
13	25	22	13	.....	.....	.....	19	19	36	.....	8.0	.....
14	24	17	14	.....	.....	.....	24	22	21	.....	12	.....
15	24	16	13	.....	.....	.....	20	24	17	.....	17	.....
16	22	14	12	.....	.....	.....	16	15	21	.....	16	.....
17	24	14	12	.....	.....	.....	17	16	17	.....	15	.....
18	24	14	12	17	.....	.....	29	13	31	.....	15	14
19	20	14	16	18	.....	18	14	12	25	.....	17	14
20	23	12	16	39	.....	19	18	36	27	.....	16	14
21	24	13	16	36	.....	18	17	24	25	.....	15	13
22	24	14	15	24	21	18	16	21	23	.....	16	14
23	25	19	19	26	19	17	16	16	24	20	21	26
24	25	14	16	29	16	21	19	14	16	15	18	29
25	24	14	18	29	14	25	17	29	22	13	30	27
26	22	13	15	26	13	22	15	24	34	16	39	26
27	24	13	19	26	12	17	18	21	34	39	30	26
28	24	19	20	21	12	22	30	16	22	13	21	24
29	20	.....	20	18	15	30	17	17	21	14	30	24
30	17	.....	19	15	27	27	14	14	23	26	36	26
31	16	.....	19	.....	31	.....	13	14	.....	21	.....	21
1911.												
1	19	.....	.....	.....	.....	.....	.....	a17	19	2.3	14	18
2	17	.....	.....	.....	.....	.....	.....	17	16	5.2	14	16
3	16	.....	.....	.....	.....	.....	.....	16	16	18	14	17
4	16	.....	.....	.....	.....	.....	.....	16	14	47	14	20
5	22	.....	.....	.....	.....	.....	.....	15	14	27	16	19
6	24	14	.....	.....	.....	.....	.....	14	17	14	17	20
7	24	16	.....	.....	.....	.....	.....	14	a21	8.8	14	20
8	16	13	.....	.....	.....	.....	.....	16	a26	8.8	14	21
9	.....	13	.....	.....	.....	.....	.....	16	a30	14	16	21
10	.....	13	.....	.....	.....	.....	.....	21	35	18	18	20
11	.....	13	.....	.....	.....	.....	.....	19	31	17	24	20
12	.....	13	.....	.....	.....	.....	.....	25	24	17	17	20
13	.....	13	.....	.....	.....	.....	.....	23	26	16	24	20
14	.....	13	.....	.....	.....	.....	.....	26	27	16	47	20
15	.....	13	.....	.....	28	.....	.....	22	39	16	32	20
16	.....	17	.....	.....	19	.....	.....	21	30	16	17	19
17	.....	21	.....	.....	17	.....	.....	22	35	17	17	19
18	.....	19	.....	.....	16	.....	.....	22	33	17	25	19
19	.....	19	.....	.....	21	.....	.....	23	34	16	26	19
20	.....	23	.....	.....	29	.....	.....	23	24	16	21	19
21	.....	20	.....	.....	37	.....	.....	20	17	19	19	19
22	.....	21	.....	.....	22	.....	21	17	17	16	21	20
23	.....	19	.....	.....	18	.....	19	16	15	16	18	19
24	.....	17	.....	.....	17	.....	.....	16	13	15	19	19
25	.....	21	.....	.....	16	.....	.....	15	5.1	15	18	18
26	.....	21	.....	.....	15	.....	.....	19	13	14	8.8	17
27	.....	22	.....	.....	19	.....	.....	20	4.3	14	8.8	16
28	.....	.....	.....	.....	22	.....	.....	17	2.4	14	16	16
29	.....	.....	.....	.....	21	.....	.....	24	2.8	16	20	16
30	.....	.....	.....	.....	.....	.....	.....	20	2.4	15	20	16
31	.....	.....	.....	.....	.....	.....	.....	25	.....	15	.....	16

a Discharge interpolated.

NOTE.—Daily discharge computed from records of head on a 20-foot weir as obtained by a Watson clock register. No records were obtained on the days for which discharge is not given.

Monthly discharge of Kapahi ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
April 15–30	48	14	16.8	533
May	67	13	24.8	1,520
June	35	13	22.0	1,310
July	51	17	29.8	1,830
August	29	16	19.8	1,220
September	32	13	18.4	1,090
October	33	12	18.2	1,120
November	26	12	15.1	898
December	38	9.3	17.0	1,050
The period				10,600
1910.				
January	25	9	21.0	1,290
February	24	12	16.1	894
March	23	12	17.2	1,060
April 1–10 and 18–30	39	13	21.9	999
May 1–8 and 22–31	31	12	17.1	601
June 1–12 and 19–30	31	17	21.7	1,030
July	30	13	17.7	1,090
August	36	12	19.6	1,210
September	36	12	21.8	1,300
October 1–9 and 23–31	41	13	20.9	746
November	39	4.7	18.3	1,090
December 1–11 and 18–31	40	13	22.1	1,100
The period				12.400
1911.				
January 1–8	24	16	19.2	305
February 6–27	23	13	17.0	742
May 15–29	37	15	21.1	628
August	26	14	19.3	1,190
September	39	2.4	20.1	1,200
October	47	2.3	16.0	984
November	47	8.8	19.0	1,130
December	21	16	18.7	1,150

TUNNEL DITCH AT KAPAHI, NEAR KAPAA, KAUAI.

Tunnel ditch is a branch of Kapahi ditch, taking water from the main ditch to the upper Kapaa reservoir.

A 10-foot weir was established on this ditch by the Territorial Public Works Department in the spring of 1909. A Watson clock register was used for recording the head on the weir.

This station was abandoned in the summer of 1911.

The records show the amount of water diverted from the main Kapahi ditch to the upper Kapaa reservoir.

Discharge measurements of Tunnel ditch at Kapahi, near Kapaa, Kauai, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 17	W. F. Martin	10.8	3.9	[a] 0.18	2.60

[a] Head on 10-foot weir.

Daily discharge, in second-feet, of Tunnel ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1						0.15	9.0	8.5	2.5	5.4	5.4	6.8
2						.09	14	9.1	1.4	5.4	.23	15
3						12	8.5	11	1.0	5.4	.18	5.6
4						12	3.6	3.3	1.0		.18	9.3
5						6.5	4.9	14	4.7		.14	15
6						1.8	7.0	4.1	2.0		.10	10
7						6.8	5.5	3.4	5.0			5.5
8						3.0	20	3.0	6.3			4.4
9						1.2	14		6.2			4.1
10						10	22		11			4.3
11						4.0	13	6.3	10			3.2
12						5.0	15	4.4	3.8			2.6
13						4.2	4.5	4.8	1.2			2.5
14							1.8	8.1	8.4		.23	2.2
15							1.5	4.6	11		.18	2.2
16							11	1.7	17		.18	2.0
17							8.7	2.3	12		.18	2.1
18							12	.23	6.6		.18	1.4
19							14	2.2	7.6		.14	2.6
20							20	9.1	2.0		.10	3.2
21							12	4.0	6.8		.06	4.7
22							12	.23	6.8		.10	4.3
23							2.0	.17	6.8		.06	27
24							.9	4.0	5.4		.10	25
25						2.2		2.0	2.7	5.4		.14	24
26						2.2		.37	4.6	5.4		.23	8.4
27						.5	10	.37	5.3	8.4		.18	.33
28						4.6	11	.36	5.7	9.9		.06	.41
29						.0	4.8	12	3.6	12		.83	.41
30						1.0	18	17	3.9	8.4		1.6	.40
31						1.5		17	3.6		5.4		.31
1910.												
1	.28	4.4	10	4.2	2.5		5.5	.30	4.3	3.0	7.0	17
2	.28	4.7	9.9	4.3	2.5		1.5	.30	10	.6	.8	14
3	.23	4.1	10	3.2	2.3		.45	.35	2.0	.7	.02	9.5
4	7.4	5.8	11	2.6	2.4		.6	8.5	3.5	.6	3.5	6.5
5	11	6.5	10	2.0	2.2	.40	.45	21	1.6	.5	5.9	7.5
6	15	6.2	10	1.4	2.6	.40	.45	22	.37	.5	5.5	8.5
7	14	4.4	10	1.0	3.2	.35	.45	8.0	.36	10		7.0
8	14	3.8	8.3	1.0	2.9	.37	.40	10	.36	7.0		6.3
9	14	3.3	6.4	.8	3.0	.40	.35	9.0	.36	12		6.0
10	14	9.2	5.8	.7	2.6	.37	.40	5.0	.30	8.4		5.8
11	14	8.4	3.9	.6	2.1	.37	.35	4.0	4.5	2.0		5.6
12	15	6.6	3.0	.6	1.0	.50	5.5	.37	10	12		5.5
13	15	7.0	2.7	.6	.5	.40	7.0	.40	16	22		5.2
14	14	5.5	3.0	.6	.40	.37	8.0	2.0	6.0	12		7.0
15	13	4.5	2.6	.6	.37	.37	7.0	9.0	2.5			6.3
16	12	3.6	2.4	.6	.7	.35	2.0	1.5	3.5	.7		4.6
17	10	3.8	1.4	7.1	.5	.35	.45	.30	2.5	.6		4.5
18	8.1	3.5	.48	4.2	.9	.25	3.5		12	.8		6.0
19	6.8	3.6	5.5	4.8	1.0	.25	1.5		15			6.5
20	7.9	3.0	.35	14	.8	.27	3.0		12		.5	6.3
21	7.8	3.9	.6	16	.7	.30	2.0	2.5	5.5		.5	5.5
22	8.6	4.2	.6	6.9	.5	.35	.35	4.2	4.5		.8	4.0
23	8.6	6.0	.6	4.8	.5	.30	.30	1.5	4.5	4.0	1.0	1.0
24	8.4	4.4	.6	4.8	.35	.35	.40	.25	5.0	2.0	.6	1.0
25	8.2	4.4	.6	4.3	.25	.45	.40	12	10	.5	15	.6
26	7.3	4.0	.6	4.1	.20	.45	.37	10	17	3.0	17	.37
27	7.6	4.4	.6	4.1	.12	.37	.40	10	18	14	12	.37
28	7.8	8.7	.6	3.6	.05	2.0	8.5	2.0	7.0	4.5	3.0	3.0
29	6.4		.6	3.0		5.0	3.0	.40	4.3	7.5	8.5	6.0
30	5.5		.6	2.5		7.2	1.0	.35	9.0	17	15	5.8
31	4.8		.6				.30	.35		8.5		5.6

Daily discharge, in second-feet, of Tunnel ditch at Kapahi, near Kapaa, Kauai, for 1909–1911—Continued.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1911.			1911.			1911.		
1	6.6	.....	11	.....	2.8	21	.....	8.0
2	6.0	.....	12	.....	2.6	22	.....	7.5
3	5.5	.....	13	.....	2.6	23	.....	7.2
4	5.3	.....	14	.....	2.6	24	.....	7.0
5	8.2	.....	15	.....	2.6	25	.....	8.1
6	9.0	2.9	16	.....	5.5	26	.....	8.7
7	8.5	3.5	17	.....	8.2	27	.....	9.0
8	.....	2.8	18	.....	7.6	28	.....	.....
9	.....	2.8	19	.....	7.4	29	.....	.....
10	.....	2.9	20	.....	8.5	30	.....	.....
						31	.....	.....

NOTE.—Daily discharge computed from records of head on a 10-foot weir as obtained by a Watson clock register. No records were obtained on the days for which discharge is not given.

Monthly discharge of Tunnel ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
May 25–31	4.6	0.00	1.71	23.7
June 1–13 and 27–30	18	.09	6.50	219
July	22	.36	9.23	568
August 1–8 and 11–31	14	.17	4.76	274
September	17	1.0	6.53	389
October 1–3 and 31	5.4	5.4	5.4	42.8
November 1–6 and 14–30	5.4	.6	0.47	21.4
December	27	.31	6.43	395
The period	.....	.....	.....	1,930
1910.				
January	15	.23	9.26	569
February	9.2	3.0	5.07	282
March	11	.35	3.98	245
April	16.	.6	3.63	216
May 1–28	3.2	.05	1.33	73.9
June 5–30	7.2	.25	0.87	44.9
July	8.5	.30	2.12	130
August 1–17 and 21–31	22	.25	5.20	289
September	18	.30	6.40	381
October 1–14, 16–18 and 23–31	22	.5	5.94	306
November 1–6 and 20–30	17	.02	5.68	192
December	17	.37	5.77	355
The period	22	.02	4.61	3,080
1911.				
January 1–7	9.0	5.3	7.01	97.3
February 6–27	9.0	2.6	5.49	240

KAPAA DITCH AT KAPAHI, NEAR KAPAA, KAUAI.

A 13-foot weir was established on Kapaa ditch below the Tunnel and Pipe branch ditches in the spring of 1909 by the Territorial Public Works Department. A Watson clock register was used to record the head on the weir.

This station was abandoned in the summer of 1911.

The records show the amount of water sent down the Kapaa ditch below the Tunnel and Pipe branch ditches.

Discharge measurements of Kapaa ditch at Kapahi, near Kapaa, Kauai, in 1909.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 17	W. F. Martin	9.8	8.9	(a)	9.4

a By weir formula, the discharge=9.3 sec.-ft.

Daily discharge in second feet of Kapaa ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1				7.1	12	7.1	9.4	8.6	6.3	7.2	19	8.5
2				9.0	12	7.1	9.7	8.0	6.2	7.4	21	11
3				7.5	38	8.6	9.4	8.3	5.8	7.9	19	11
4				7.0	37	9.0	7.8	8.5	5.4	7.1	18	11
5				6.8	19	9.0	7.8	10	6.1	6.4	10	13
6				6.0	17	7.8	7.1	8.8	6.2	8.2	8.9	11
7				6.5	18	7.8	7.1	8.4	6.5	6.8	8.2	11
8				7.5	17	7.5	9.4	9.2	6.2	10	8.2	10
9				9.0	18	12	5.1	8.3	6.1	9.7	9.0	9.3
10			0.00	10	45	7.8	4.2	9.3	6.8	3.9	11	8.5
11			.00	4.3	22	7.1	6.1	11	6.8	5.5	18	7.7
12			.00	.06	18	7.1	8.2	8.2	5.7	6.1	17	7.8
13			.00	.00	19	6.8	11	7.7	8.1	5.5	20	7.8
14			.00	.00	17	6.4	18	8.4	7.5	4.2	17	8.6
15			.35	4.5	16	6.8	15	.....	7.0	12	9.6	9.7
16			2.1	9.4	20	7.5	25	.....	6.5	10	8.2	9.4
17			3.5	.....	14	9.0	15	.....	6.0	7.1	7.4	9.4
18			5.0	.....	12	8.2	15	.....	5.4	8.6	6.8	8.9
19			1.6	9.6	15	9.4	17	.....	4.8	11	6.0	8.9
20			1.7	9.6	17	10	22	.....	6.8	11	11	8.9
21			3.1	9.6	12	11	16	.....	7.5	7.1	11	9.3
22			3.0	10	12	11	17	.....	7.5	7.1	6.0	9.3
23			.8	10	11	11	14	9.3	8.2	10	6.0	11
24			.0	10	10	11	12	10	6.8	9.4	6.0	12
25			3.4	10	8.2	14	36	8.2	6.2	14	6.8	12
26			7.5	10	7.5	15	28	8.5	5.2	13	9.3	12
27			6.3	10	7.5	11	40	7.8	8.2	17	7.2	9.4
28			6.2	10	12	11	30	7.3	11	25	11	10
29			12	10	9.4	8.6	16	6.9	14	23	8.1	11
30			10	12	7.8	9.4	11	6.8	9.1	16	8.1	9.7
31			6.0	.....	7.8	.....	7.1	6.7	.....	19	.....	9.4

Daily discharge in second feet of Kapaa ditch at Kapahi, near Kapaa, Kauai, for 1909–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	8.9	11	.....	10	6.8	20	9.0	7.8	8.6	10	4.5	19
2	9.0	11	.....	12	9.0	17	7.8	7.5	8.6	9	9.0	16
3	9.0	11	.....	15	7.8	22	9.4	8.6	8.2	13	10	9.7
4	9.7	12	.....	12	8.2	17	15	8.2	8.2	8.2	10	15
5	11	14	.....	8.9	7.5	14	11	8.6	10	14	23	15
6	12	14	.....	10	9.0	14	11	6.8	8.6	9.7	8.6	20
7	11	12	12	12	14	12	9.4	11	7.8	10	.....	15
8	11	11	8.9	9.5	.....	15	8.2	11	7.5	10	.....	13
9	11	11	7.4	8.1	.....	18	7.8	7.1	8.6	.....	.....	11
10	11	13	6.4	7.2	.....	13	9.0	7.8	8.6	.....	.....	12
11	11	17	6.8	7.3	.....	11	8.6	9.0	9.0	.....	.....	14
12	11	14	7.8	7.7	.....	21	13	8.2	9.0	.....	.....	15
13	11	13	7.7	8.0	.....	19	9.0	8.2	10	.....	.....	14
14	11	13	7.4	7.4	.....	18	9.0	10	13	.....	.....	13
15	11	11	9.7	7.3	.....	18	8.2	9.7	13	.....	.....	10
16	11	11	6.3	7.6	12	17	8.6	8.6	15	.....	.....	7.8
17	14	10	6.8	11	9.4	17	17	8.6	10	9.4	.....	7.5
18	15	10	7.5	9.3	11	18	11	7.8	8.6	9.4	.....	7.1
19	14	10	10	9.3	18	12	9.4	7.5	8.2	13	.....	.....
20	15	9.0	11	13	18	13	11	7.5	11	14	.....	.....
21	15	9.7	9.7	15	17	12	8.6	9.0	11	12	.....	.....
22	16	10	9.1	11	9.0	12	9.0	10	10	11	.....	.....
23	16	13	13	14	15	11	9.0	10	10	10	.....	.....
24	16	10	11	18	9.7	13	.....	9.0	10	13	.....	.....
25	16	9.7	12	18	8.6	19	.....	10	9.4	6.1	.....	.....
26	15	9.4	9.7	16	7.8	13	.....	10	16	18	.....	.....
27	15	.....	12	20	8.2	12	.....	9.0	14	11	12	.....
28	16	.....	14	13	6.8	13	.....	7.8	10	6.8	13	.....
29	14	.....	13	9.3	11	18	.....	8.2	11	7.5	16	.....
30	12	.....	13	7.9	14	15	.....	7.8	11	8.6	17	.....
31	12	.....	13	.....	20	.....	12	8.6	.....	10	.....	.....

Day.	Feb.	Mar.	Apr.	May.	Day.	Feb.	Mar.	Apr.	May.
1911.					1911.				
1	.....	10	3.9	.....	16	11	5.7	9.4	14
2	.....	9.7	4.2	4.8	17	11	8.2	13	.....
3	.....	9.4	4.5	7.1	18	8.2	7.8	13	.....
4	.....	9.7	9.0	11	19	6.4	.....	13	.....
5	.....	7.1	7.5	11	20	10	.....	13	.....
6	11	7.1	7.5	.....	21	9.4	.....	13	.....
7	14	9.7	7.1	.....	22	8.6	.....	13	.....
8	11	10	8.2	.....	23	8.2	.....	13	.....
9	11	11	9.4	12	24	7.5	7.8	13	.....
10	11	9.7	11	15	25	8.6	9.7	.....	.....
11	11	10	9.7	11	26	11	7.5	.....	.....
12	11	10	9.4	13	27	10	5.5	.....	.....
13	11	7.1	11	14	28	11	6.1	.....	.....
14	9.0	6.4	5.7	14	29	.....	3.9	.....	.....
15	7.8	5.7	7.1	14	30	.....	3.9	.....	.....

NOTE.—Daily discharge computed from records of head on a 13-foot weir as obtained by a Watson clock register. No records were obtained on the days for which discharge is not given.

Monthly discharge of Kapaa ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
March 10–31	12	0.00	3.30	144
April 1–16 and 19–30	12	.00	7.70	427
May	45	7.5	16.4	1,010
June	15	6.4	9.17	546
July	40	4.2	14.7	904
August 1–14 and 23–31	11	6.7	8.44	385
September	14	5.2	7.00	417
October	25	3.9	10.2	627
November	21	6.0	11.1	660
December	13	7.7	9.89	608
The period				5,730
1910.				
January	16	8.9	12.6	775
February 1–26	17	9.0	11.5	593
March 7–31	14	6.3	9.81	486
April	20	7.2	11.2	666
May 1–7 and 16–31	20	6.8	11.2	511
June	22	11	15.5	922
July 1–23 and 31	17	7.8	10.0	476
August	11	6.8	8.67	533
September	16	7.5	10.1	601
October 1–8 and 17–31	14	6.1	10.6	484
November 1–6 and 27–30	23	4.5	12.3	244
December 1–18	20	7.1	13.0	464
The period	23	4.5	11.3	6,760
1911.				
February 6–28	14	6.4	9.94	453
March 1–18 and 24–30	11	3.9	7.95	394
April 1–24	13	3.9	9.52	453
May 2–5 and 9–16	15	4.8	11.7	278

PIPE DITCH AT KAPAHI, NEAR KAPAA, KAUAI.

Pipe ditch is a diversion from the main Kapahi ditch below Tunnel branch ditch and above the lower Kapaa weir.

A 10-foot weir was established on this ditch by the Makee Sugar Co., and a Watson clock register was installed by the Territorial Public Works Department in the summer of 1909, to record the head on the weir.

This station was abandoned in the spring of 1911.

Discharge measurements of Pipe ditch at Kapahi, near Kapaa, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 4	W. F. Martin	7.3	13.0	[a] 0.60	10.1

[a] Head on 6-foot weir.

NOTE.—Weir has poor end contractions. Considerable velocity of approach and some leakage around sides of weir.

Daily discharge, in second-feet, of Pipe ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	.....	.....	.....	4.9	4.3	4.8	5.2	5.0	5.7	5.7	4.8	2.3
2	.....	.....	.....	4.5	4.5	5.2	5.2	5.4	5.6	5.8	1.1	1.3
3	.....	.....	.....	2.6	.5	5.1	4.7	5.4	5.3	6.2	7.5	.1
4	.....	.....	.....	4.4	.6	5.1	5.2	5.3	5.8	5.7	7.1	.1
5	.....	.....	.....	4.3	4.4	4.7	5.0	5.4	5.6	5.2	6.7	.1
6	.....	.....	.....	5.7	4.3	4.5	5.2	5.3	5.6	5.4	6.2	.1
7	.....	.....	.....	4.2	4.3	4.7	5.2	5.2	5.6	5.5	5.7	.1
8	.....	.....	.....	4.4	4.3	5.0	5.1	6.3	5.8	5.3	5.6	.3
9	.....	.....	.....	4.4	4.6	.5	5.1	4.9	5.4	5.1	5.5	.6
10	.....	.....	.....	4.6	4.7	5.1	5.1	4.7	5.7	5.7	5.5	1.4
11	.....	.....	.....	4.3	4.5	5.5	4.8	4.9	5.1	4.6	5.4	1.9
12	.....	.....	.....	4.8	4.2	4.6	5.3	5.1	5.6	4.6	5.6	1.9
13	.....	.....	.....	.0	4.5	4.6	5.4	5.3	5.6	1.4	5.0	1.9
14	.....	.....	.....	.2	4.1	4.9	5.3	4.8	5.7	.9	1.1	1.0
15	.....	.....	.....	4.2	4.1	5.1	5.3	6.3	5.6	4.9	5.4	.1
16	.....	.....	.....	4.6	.3	4.9	5.2	5.5	5.4	5.3	5.5	.1
17	.....	.....	.....	4.4	4.2	5.1	5.3	5.5	5.4	5.0	5.5	.1
18	.....	.....	.....	4.2	4.3	5.0	5.3	5.4	5.5	5.4	5.5	.1
19	.....	.....	.....	4.6	4.3	5.1	5.1	5.0	5.5	5.3	5.4	.1
20	.....	.....	.....	4.3	4.3	5.1	5.8	.6	5.8	5.3	4.7	.1
21	.....	.....	.....	4.5	4.2	5.1	5.5	4.3	5.7	5.1	2.7	.1
22	.....	.....	.....	4.2	4.1	5.1	5.3	5.5	6.0	5.8	5.0	.1
23	.....	.....	.....	4.6	4.1	5.1	5.3	5.3	5.6	5.7	5.1	.1
24	.....	.....	.....	4.3	4.3	5.1	5.3	5.7	5.6	5.3	5.2	.1
25	.....	.....	.....	4.0	4.1	.7	5.3	5.4	5.6	6.0	5.2	.1
26	.....	.....	.....	4.5	4.2	.7	5.2	5.1	5.5	5.8	5.7	.1
27	.....	.....	.....	4.5	4.7	4.7	5.5	5.4	6.0	5.8	4.4	.1
28	.....	.....	.....	4.5	4.9	5.1	5.2	5.3	5.7	5.1	.5	.1
29	.....	.....	.....	4.6	4.6	5.1	5.3	5.5	6.2	.6	2.1	.1
30	.....	.....	.....	4.2	4.8	5.4	.6	5.7	5.6	6.0	1.8	.1
31	.....	.....	4.6	.....	4.8	.....	.4	5.7	.....	6.7	.....	.1
1910.												
1	0.1	0.1	.0	4.0	5.0	.4	5.1	5.3	5.0	4.5	4.7	1.4
2	.0	.1	.0	4.2	4.8	.4	5.8	5.2	5.2	4.5	4.6	1.4
3	.1	.1	.0	4.4	4.6	.5	5.7	5.3	5.4	4.5	4.2	1.5
4	.1	.2	.0	4.5	5.1	5.0	4.3	5.4	5.5	4.5	.2	.4
5	.2	.2	.0	4.7	4.4	5.4	5.4	5.4	5.2	4.5	.1	1.9
6	.1	.3	.0	4.7	4.4	5.0	5.4	5.2	5.4	4.5	.1	2.0
7	.1	.2	.0	4.7	4.5	4.9	5.5	.2	5.4	4.5	.1	2.0
8	.1	.2	1.3	4.7	4.9	5.1	5.4	3.8	5.3	4.5	1.8	1.8
9	.1	.2	1.8	4.7	5.1	5.0	5.5	5.1	5.6	4.5	3.1	1.8
10	.1	.2	2.5	4.9	4.8	5.0	6.0	5.4	5.2	4.5	.4	1.9
11	.1	.4	2.5	4.4	4.8	4.7	5.1	5.4	4.9	3.1	2.2	.....
12	.1	.3	2.9	4.7	4.5	.5	5.1	5.8	5.2	5.2	2.2	.....
13	.1	.2	3.5	4.6	4.7	4.5	5.2	4.7	5.4	5.5	2.9	.....
14	.1	.1	3.0	4.3	4.6	5.3	5.6	5.5	5.4	4.9	2.6	.....
15	.1	.1	.3	4.2	4.8	5.3	4.4	5.2	5.0	5.2	2.1	.....
16	.1	.1	3.0	4.6	5.2	5.1	5.6	5.3	5.5	5.5	1.5	.....
17	.1	.1	3.1	4.7	4.5	5.2	.5	5.1	5.0	4.6	2.1	.....
18	.1	.1	3.5	4.6	5.1	5.4	6.2	5.3	5.9	5.0	1.5	.....
19	.1	.1	3.6	4.8	4.7	5.9	.4	5.0	5.1	5.0	1.9	.....
20	.1	.1	3.7	5.6	5.0	5.4	3.8	5.1	5.2	5.5	2.7	.....
21	.1	.2	3.8	4.9	5.0	5.4	5.2	4.6	5.8	4.8	2.3	.....
22	.1	.1	3.9	5.3	8.2	5.4	5.6	5.2	5.5	5.2	2.3	.....
23	.1	.1	4.3	5.0	4.9	5.4	5.6	5.2	5.0	4.7	2.4	.....
24	.2	.1	3.9	5.6	5.1	5.1	5.6	5.3	5.3	4.8	1.5	.....
25	.2	.1	4.3	5.3	5.0	4.9	5.1	5 3	5.9	4.8	2.9	.....
26	.2	.1	4.0	5.0	4.8	5.1	5.3	5.3	5.1	4.8	1.8	.....
27	.2	.0	4.2	4.0	5.1	5.4	5.4	5.3	6.2	4.8	2.0	.....
28	.2	.0	4.5	4.7	4.4	5.8	5.2	6.2	.4	4.8	1.9	.....
29	.2	.....	4.1	4.8	2.8	5.3	5.2	5.5	5.4	4.7	1.4	.....
30	.2	.....	4.2	5.1	4.9	5.1	5.2	5.2	5.2	4.7	.7	.....
31	.2	.....	3.9	.....	.4	.....	.3	5.1	.....	4.7	.....	.....

Daily discharge, in second-feet, of Pipe ditch at Kapahi, near Kapaa, Kauai, for 1909–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1911.									
1	.....	0.1	2.2	0.5	16	.....	1.7	5.4	4.1
2	.....	1.5	2.1	.5	17	.....	1.8	4.3	4.0
3	.....	.4	3.4	3.8	18	.....	.6	4.7	3.9
4	.....	.5	6.0	3.9	19	.....	2.0	5.4	3.8
5	.....	.0	6.0	3.2	20	.....	3.1	5.4	3.7
6	.....	.0	6.0	3.5	21	.....	3.0	5.4	3.6
7	.....	.0	5.8	3.6	22	.....	2.9	5.6	3.5
8	.....	.0	5.2	2.9	23	.....	3.2	3.7	2.0
9	.....	.0	5.0	3.5	24	.....	3.2	3.1	.....
10	.....	.0	4.9	3.5	25	.....	1.7	.5	.....
11	.....	.0	4.7	3.6	26	.....	2.2	.6	.....
12	.....	.0	5.0	3.9	27	.....	2.8	1.6	.....
13	.....	.0	4.7	4.3	28	.....	2.8	1.6	.....
14	.....	.0	4.9	4.3	29	.....	.....	1.6	.....
15	.....	.0	5.8	4.2	30	0.0	.....	2.4	.....
					31	.0	.....	2.4	.....

NOTE.—Daily discharge computed from records of head on a 6-foot weir as obtained by a Watson clock register and are probably too small, as the weir has poor end contractions with considerable velocity of approach and some leakage around sides. Discharge interpolated for periods Nov. 4–6, 1909; Apr. 3–4 and Oct. 2–9, 1910; and Apr. 15–21, 1911.

Monthly discharge of pipe ditch at Kapahi, near Kapaa, Kauai, for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
April	5.7	0.0	4.12	245
May	4.9	.3	4.00	246
June	5.5	.5	4.56	271
July	5.8	.4	4.93	303
August	6.3	.6	5.17	318
September	6.2	5.1	5.63	335
October	6.7	.6	5.04	310
November	7.5	.5	4.75	283
December	2.3	.1	.48	29.5
The period	.....	.....	.....	2,340
1910.				
January	.2	.0	.13	7.99
February	.4	.0	.15	8.33
March	4.5	.0	2.57	158
April	5.6	4.0	4.72	281
May	8.2	.4	4.71	290
June	5.9	.4	4.56	271
July	6.2	.3	4.83	297
August	6.2	.2	5.06	311
September	6.2	.4	5.19	309
October	5.5	3.1	4.75	292
November	4.7	.1	2.01	120
December 1–10	2.0	.4	1.61	32
The period	.....	.....	.....	2,380
1911.				
February	3.2	.0	1.20	66.6
March	6.0	.6	4.05	249
April 1–23	4.3	.5	3.38	154

KANEHA DITCH AT KANEHA, NEAR KEALIA, KAUAI.

Kaneha ditch diverts water from the north side of Kealia Stream at elevation 870 feet. A 20-foot weir was established by the Makee Sugar Co. on this ditch about 1 mile below the intake August 17, 1907.

The head was recorded from daily observations until the summer of 1910, when a Watson clock register, furnished by the Territorial Public Works Department, was installed by the company.

Records on this ditch show the amount of water diverted from Kealia Stream for irrigation on the north side.

The record of head on the weir from January 1, 1909, to July 31, 1911, has been furnished to the Geological Survey by the Makee Sugar Co. Since August, 1911, the company has cooperated with the Geological Survey in maintaining this station by having its ditchman attend to the clock register.

Discharge measurements of Kaneha ditch at Kaneha, near Kealia, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 13	W. V. Hardy	14.0	4.93	*a* 0.16	3.71
18	do	14.0	5.81	*a* 0.20	5.20

a Head on 20-foot weir.

NOTE.—Measurements made by wading about 20-feet below weir.

Daily discharge, in second-feet, of Kaneha ditch at Kaneha, near Kealia, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	6.9	12	6.0	6	24	6	8.3	8.3	6	6	31	6
2	6.9	12	17	57	57	6	8.3	11	6	6	6	24
3	6.9	12	17	17	31	17	8.3	8.3	6	11	2.1	6
4	6.9	13	24	17	31	11	8.3	8.3	6	6	2.1	6
5	6.9	14	17	11	21	11	8.3	11	17	6	2.1	77
6	6.4	16	17	6	17	8.3	8.3	8.3	6	6	2.1	11
7	6.0	17	11	11	17	17	8.3	8.3	8.3	6	8.3	8.3
8	5.5	17	11	11	17	8.3	24	8.3	11	6	2.1	11
9	5.1	17	11	6	17	6	11	8.3	11	6	2.1	6
10	6	16	24	6	57	17	24	8.3	14	6	2.1	6
11	13	16	24	6	17	8.3	11	6	8.3	6	11	6
12	13	16	24	6	17	8.3	11	6	8.3	6	11	6
13	13	16	24	6	11	8.3	8.3	11	11	24	11	6
14	14	16	24	6	11	8.3	14	8.3	6	31	11	6
15	14	15	24	6	11	8.3	8.3	6	11	9.9	11	6
16	14	14	24	6	11	8.3	17	6	11	11	6	6
17	14	14	24	6	11	8.3	11	6	8.3	6	6	6
18	14	14	24	6	11	11	11	6	8.3	6	6	6
19	14	14	24	6	11	17	17	6	8.3	6	6	6
20	13	14	11	6	11	11	24	6	8.3	6	6	6
21	13	14	11	6	8.3	20	11	6	6	6	6	6
22	13	13	11	6	8.3	17	11	6	6	6	11	88
23	12	13	11	6	8.3	11	8.3	8.3	6	11	11	24
24	12	13	6	6	8.3	17	8.3	11	6	6	6	57
25	13	12	6	6	8.3	11	43	8.3	6	11	6	24
26	13	12	6	6	6	11	11	8.3	6	11	6	24
27	12	12	2.1	6	6	11	31	6	6	11	6	24
28	12	11	6	6	11	11	14	8.3	6	2.8	6	24
29	12	.....	2.1	11	6	8.3	17	6	8.3	11	6	24
30	12	.....	6	99	6	11	11	8.3	6	8.3	6	24
31	12	.....	6	.....	6	.....	11	8.3	.....	17	.....	24

Daily discharge, in second feet, of Kaneha ditch at Kaneha, near Kealia, Kauai, for 1909–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	11	11	11	11	8.3	24	11	6	6	6	8.3	17
2	11	11	17	17	8.3	24	8.3	6	11	8.3	8.3	8.3
3	11	11	17	11	6	24	8.3	6	6	8.3	8.3	8.3
4	11	11	17	8.3	6	24	8.3	8.3	6	17	8.3	8.3
5	11	11	11	11	11	11	8.3	31	6	8.3	8.3	17
6	11	11	17	6	11	11	8.3	11	6	8.3	8.3	17
7	11	11	11	6	11	8.3	6	8.3	11	8.3	8.3	11
8	11	8.3	11	6	11	8.3	6	8.3	6	17	8.3	8.3
9	11	8.3	6	6	8.3	8.3	6	8.3	8.3	17	8.3	11
10	11	31	6	6	6	8.3	6	8.3	6	6.4	11	8.3
11	11	11	6	6	6	8.3	6	8.3	17	6.4	17	8.3
12	11	11	6	11	6	17	17	6	39	6.4	17	8.3
13	11	11	6	6	6	17	6	6	6	31	11	6
14	11	11	6	6	6	24	11	6	11	8.3	11	6
15	6	8.3	6	6	6	17	8.3	6	8.3	8.3	6	2.1
16	6	8.3	6	6	11	11	14	6	8.3	8.3	16	2.1
17	6	8.3	6	31	6	17	14	11	8.3	8.3	11	2.1
18	11	8.3	6	11	11	11	39	6	110	8.3	8.3	2.1
19	11	8.3	6	11	39	8.3	8.3	6	24	17	17	2.1
20	11	8.3	6	24	17	8.3	14	14	11	8.3	8.3	2.1
21	11	8.3	6	31	11	8.3	6	24	17	8.3	8.3	2.1
22	11	8.3	6	11	11	8.3	6	11	11	8.3	8.3	2.1
23	11	8.3	8.3	17	11	8.3	6	11	20	8.3	8.3	6
24	11	6	6	57	6	39	6	6	11	8.3	8.3	17
25	11	6	8.3	110	6	31	31	62	11	8.3	17	17
26	11	6	6	24	6	11	11	14	17	8.3	20	17
27	11	6	11	17	6	11	31	8.3	17	6	11	6
28	11	17	24	11	6	57	31	8.3	11	6	8.3	11
29	11	.....	24	8.3	57	17	8.3	8.3	11	6	17	11
30	11	.....	11	8.3	24	17	8.3	6	11	8.3	17	11
31	11	.....	11	.....	24	.....	6	6	.....	8.3	.....	11
1911.												
1	2.1	6	8.3	8.3	2.1	11	6	.....	3.9	13	1.8	3.9
2	2.1	6	8.3	8.3	2.1	11	6	.....	1.9	12	1.8	5.7
3	2.1	6	8.3	8.3	2.1	17	6	.....	2.4	15	1.8	5.5
4	2.1	6	8.3	8.3	2.1	17	6	.....	4.2	12	1.7	2.1
5	11	6	8.3	8.3	2.1	11	6	.....	3.1	9.0	1.8	2.6
6	11	6	8.3	8.3	2.1	11	11	.....	2.0	7.8	1.8	2.2
7	31	6	11	8.3	8.3	17	2.1	.....	2.8	7.0	1.5	0.1
8	17	6	11	8.3	17	6	2.1	.....	2.9	6.5	1.5	0.1
9	8.3	6	8.3	8.3	17	6	2.1	.....	2.8	5.5	3.5	11
10	11	6	8.3	8.3	17	6	6	.....	4.6	2.6	2.2	13
11	11	6	8.3	8.3	11	11	11	.....	4.4	2.2	2.2	13
12	17	6	8.3	8.3	3.9	6	6	.....	2.8	2.4	2.2	12
13	11	6	8.3	17	3.9	17	11	7.3	1.8	2.2	1.9	7.3
14	11	6	8.3	11	3.9	17	17	7.8	5.9	6.0	1.8	6.2
15	6	2.1	8.3	11	11	8.3	2.1	6.4	12	3.5	1.8	6.2
16	6	2.1	8.3	11	11	8.3	2.1	6.0	12	2.2	2.0	6.2
17	24	2.1	8.3	11	8.3	8.3	2.1	7.3	9.2	2.1	1.6	6.3
18	11	2.1	8.3	17	6	6	6	6.4	3.9	2.1	1.6	6.2
19	6	2.1	8.3	11.	6	11	2.1	5.1	1.5	2.1	1.8	5.5
20	6	2.1	8.3	14	3.9	6	2.1	12	9.7	2.0	1.8	4.4
21	6	2.1	8.3	17	6	11	2.1	7.7	13	1.9	2.1	4.9
22	6	2.1	6	11	31	6	6	7.1	4.7	1.8	1.5	12
23	6	2.1	17	17	11	6	2.1	4.7	2.1	1.8	9.9	18
24	6	17	11	17	11	6	2.1	3.1	0.2	1.8	8.3	8.9
25	6	8.3	11	11	11	6	2.1	4.7	0.0	1.8	16	5.7
26	11	11	11	6	11	6	2.1	3.3	3.3	2.1	20	4.6
27	11	17	17	11	17	6	39	1.0	5.3	1.9	16	0.2
28	17	11	17	6	24	17	24	0.4	16	1.8	7.3	2.3
29	6	.....	17	6	11	11	6	0.2	12	2.0	5.7	4.7
30	6	.....	11	2.1	17	6	6	0.3	12	2.1	3.9	4.7
31	6	.....	6	.....	17	.....	6	7.8	.....	2.0	.....	4.7

NOTE.—Daily discharge computed from records of head on a 20-foot weir. No record for period Aug. 1–12, 1911.

Monthly discharge of Kaneha ditch at Kaneha, near Kealia, Kauai, for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
January	14	5.1	10.8	664
February	17	11	14.1	783
March	24	2.1	14.7	904
April	99	6.0	12.2	726
May	57	6.0	15.9	978
June	20	6.0	11.1	660
July	43	8.3	13.8	849
August	11	6.0	7.76	477
September	17	6.0	8.08	481
October	31	2.8	8.97	552
November	31	2.1	7.17	427
December	88	6.0	18.2	1,120
The year	99	2.1	11.9	8,620
1910.				
January	11	6.0	10.5	646
February	31	6.0	10.2	566
March	24	6.0	9.94	611
April	110	6.0	16.7	994
May	57	6.0	11.9	732
June	57	8.3	16.6	988
July	39	6.0	11.8	726
August	62	6.0	11.0	676
September	110	6.0	15.1	899
October	31	6.0	6.45	397
November	20	6.0	11.1	660
December	17	2.1	8.61	529
The year	110	2.1	11.6	8,420
1911.				
January	31	2.1	9.48	583
February	17	2.1	5.97	332
March	17	6.0	9.80	603
April	17	2.1	10.2	607
May	31	2.1	9.93	611
June	17	6.0	9.76	581
July	39	2.1	6.85	421
August 13–31	12	0.2	5.19	196
September	16	0.0	5.41	322
October	15	1.8	4.46	274
November	20	1.5	4.29	255
December	18	0.1	6.14	378
The period	39	0.0	7.13	5,160

ANAHOLA RIVER BASIN.

GENERAL FEATURES.

The Anahola basin lies on the eastern slope of Kauai, south of the Anahola Mountains. It is about 7 miles long and from 1 to 3 miles wide, and comprises a total area of 8 to 10 square miles. It extends back to the summits of Namahana and Puu Eu peaks, with elevations of 2,805 and 2,748 feet, respectively. The entire basin is in public ownership.

The principal tributary is Keaoopu Stream from the north.

The rainfall ranges from 60 inches at sea level to probably 300 inches at the head.

Water is diverted from the south side of Anahola River at elevation of 350 feet for cane irrigation, and at other points near the mouth for rice irrigation.

Gaging stations have been established on the main stream above Anahola dam and at two points on Anahola ditch.

ANAHOLA RIVER ABOVE DAM AT KIOKALA, NEAR KEALIA, KAUAI.

A staff gage was established on Anahola Stream about one-fourth mile above the dam at Kiokala, July 11, 1910, and four measurements made during the same month.

On August 22, 1910, a Friez clock register was installed. This was maintained until November 2, 1910, when the gage house and clock were carried away by a flood.

The records at this station show the total flow of Anahola River above all diversions.

Discharge measurements of Anahola River above dam at Kiokala, near Kealia, Kauai, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 11	W. F. Martin	34	45.0	0.90	[a] 14.4
11	A. G. Schnack	22	21.0	0.90	12.3
16	do	20	23.0	0.93	14.9
30	do	20.2	23.3	0.95	16.4

[a] Results uncertain, owing to low velocity in measuring section.

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Anahola River above dam at Kiokala, near Kealia, Kauai, for 1910.

[Makee Sugar Co., observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.1				16		0.85	0.95		
2		.9	0.95			17		1.1	.95		
3		.9	1.05			18		1.0	1.1		
4		.9	1.15		0.95	19		2.05	.95		
5		.85	1.05			20		1.5	.95	1.0	
6		.85	1.0	2.9		21		1.1	1.05		
7		.85	1.0			22	0.9	1.1	1.1		
8		.85	1.15			23	.85	1.5	1.1		
9		.85	1.15			24	.8	1.15			
10		.85	.95			25	1.25	1.1			
11		.8	.9			26	1.0	1.05			
12		1.0	1.1			27	.85			1.0	
13		1.25	1.5	2.0		28	.9				
14		.95	1.05			29	.9				
15		.85	.95			30	.85		1.45		
						31	.85				

Daily discharge, in second-feet, of Anahola River above dam at Kiokala, near Kealia, Kauai, for 1910.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		30				16		10	17		
2		13	17			17		30	17		
3		13	26			18		21	30		
4		13	35		17	19		170	17		
5		10	26			20		74	17	21	
6		10	21	355		21		30	26		
7		10	21			22	13	30	30		
8		10	35			23	10	74	30		
9		10	35			24	6	35			
10		10	17			25	46	30			
11		6	13			26	21	26			
12		21	30			27	10			21	
13		46	74	160		28	13				
14		17	26			29	13				
15		10	17			30	10		68		
						31	10				

NOTE.—Daily discharge computed from a rating curve that is fairly well defined between 11 and 18 second-feet. Above 20 second-feet the estimates are only approximate.

ANAHOLA RIVER AT DAM AT KIOKALA, NEAR KEALIA, KAUAI.

This station was established December 15, 1910, just above the diversion dam for the Anahola ditch at Kiokala. The crest of the dam forms the controlling section and hence the gage heights are influenced only by the amount of water passing over the dam, without regard to that diverted by the Anahola ditch.

A Friez clock register is used for obtaining gage heights.

High-water measurements are made from a wire foot-bridge about 50 feet above the dam. These measurements include total flow of the stream above the diversion for Anahola ditch.

Measurements at ordinary and low stages can be made either on the crest of the dam or in the stream bed a short distance below.

The width of the stream at this point varies from 60 to 100 feet, and the range of stage is from 6 to 7 feet.

To obtain the otal flow of the Anahola River add the discharge at this station to that of the Anahola ditch at Kiokala, corrected for loss by leakage between the intake and the weir.

Discharge measurements of Anahola River at dam at Kiokala, near Kealia, Kauai, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 15*a*	Martin and Mendes	23.4	7.9	1.01	8.9
17*a*	do	23.4	7.4	.99	7.6
1911.					
Feb. 10*b*	Martin and Hoyt	44	120	1.64	71
July 21*a*	Martin and Hardy	23.5	7.8	1.02	8.6
31*c*	W. V. Hardy	5.4	4.1	.87	2.87
Aug. 6*d*	do			.70	.25
13*c*	do	3.5	2.9	.86	2.35
28*d*	do			.66	.10
Sept. 28*a*	do	24.5	15.5	1.36	32.2

a Measurement made by wading on crest of dam.
b Measurement made from footbridge. Head gates of Anahola ditch closed and total flow of stream going over dam.
c Measurement made by wading delow dam.
d Discharge estimated.

NOTE.—These are measurements of water flowing over dam, and do not include water diverted by Anahola ditch.

Daily gage height, in feet, of Anahola River at dam at Kiokala, near Kealia, for 1910–11.

[Makee Sugar Co., observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	0.95
2		12		22	.95
3		13		23	1.0
4		14		24	1.6
5		15		25	1.65
6		16		26	1.75
7		17		27	1.45
8		18	1.0	28	1.25
9		19	.95	29	1.2
10		20	.95	30	1.2
				31	1.15

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.1	1.65	1.2			1.1		0.9	1.0	1.5	1.0	1.15
2	1.05	1.55	1.1			1.15		.9	.75	1.35	1.0	1.15
3	1.0	1.4	1.05			1.05		.85	.75	1.35	1.0	1.15
4	1.0	1.65	1.05			.95		.8	.7	1.45	1.0	1.25
5	1.6	1.5	1.05			1.0		.8	.95	1.3	1.0	1.15
6	1.25	3.5	1.05			1.1		.7	.75	1.3	1.05	1.25
7	1.45	2.0	1.1			.95		.75	.7	1.25	1.0	1.25
8	2.1	1.65	1.2			.9		.75	.65	1.2	1.0	1.45
9	1.8	2.5	1.1			.95		.75	.65	1.2	1.0	1.7
10	1.55	1.65	1.1			.9		.8	1.25	1.1	1.15	1.4
11	1.5	1.55	1.05			.9		.85	1.45	1.0	1.2	1.6
12	1.7	1.45	1.05			.9		.9	1.25	.95	1.0	1.4
13	1.4	1.45	1.05		0.9	1.1		1.25	1.05	.95	1.15	1.4
14	1.35	1.35	1.05		1.0	1.4		1.15	1.05	.95	1.35	1.35
15	1.25	1.3	1.1		1.3	1.05		.9	1.2	1.05	1.3	1.45
16	1.55	1.3	1.1		1.0	.95		.85	1.05	1.05	1.1	1.2
17	2.0	1.25	1.25		.85	.95		.85	1.25	1.05	1.2	1.35
18	1.45	1.15	1.35		.85			.85	1.25	1.05	1.2	1.15
19	1.35	1.05	1.25		.85			1.4	1.05	1.0	1.45	1.1
20	1.3	1.15	1.2		1.3			1.0	1.15	1.05	1.1	1.1
21	1.25	1.15	1.3				1.05	1.0	2.45	1.3	1.1	1.15
22	1.2	1.15	1.7				.85	.95	2.3	1.05	1.1	1.65
23	1.2	1.2	1.7				.8	1.05	1.45	1.0	1.0	1.45
24	1.35	1.4	1.35				.8	.9	2.80	1.0	1.7	1.1
25	1.5	1.15	2.85				.8	.85	1.6	1.0	1.5	1.05
26	1.35	1.5	2.15				.75	.9	1.7	.95	1.75	.95
27	2.15	2.1			1.1		1.6	1.0	1.5	.95	2.0	.95
28	2.3	1.4			2.0		1.6	.75	1.35	.95	1.4	1.3
29	1.55				1.6		1.2	.65	1.25	1.0	1.3	1.55
30	1.4				1.2		1.0	1.1	1.2	1.0	1.25	1.2
31	1.5				1.15		.9	1.45		1.0		1.1

NOTE.—Gage heights estimated for periods Feb. 6-9, Feb. 28–Mar. 5, July 29–30, and Aug. 24-25, 1911.

Daily discharge, in second-feet, of Anahola River at dam at Kiokala, near Kealia, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	5.9
2		12		22	5.9
3		13		23	8.0
4		14		24	64
5		15		25	73
6		16		26	92
7		17		27	42
8		18	8.0	28	23
9		19	5.9	29	19
10		20	5.9	30	19
				31	16

Daily discharge, in second-feet, of Anahola River at dam of Kiokala, near Kealia, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	13	73	19	.....	.....	13	.....	3.8	8.0	48	8.0	16
2	10	56	13	.....	.....	16	.....	3.8	.7	32	8.0	16
3	8.0	37	10	.....	.....	10	.....	2.5	.7	32	8.0	16
4	8.0	73	10	.....	.....	5.9	.....	1.2	.2	42	8.0	23
5	64	48	10	.....	.....	8.0	.....	1.2	5.9	27	8.0	16
6	23	610	10	.....	.....	13	.....	.2	.7	27	10	23
7	47	141	13	.....	.....	5.9	.....	.7	.2	23	8.0	23
8	162	73	19	.....	.....	3.8	.....	.7	.0	19	8.0	42
9	101	265	13	.....	.....	5.9	.....	.7	.0	19	8.0	82
10	56	73	13	.....	.....	3.8	.....	1.2	23	13	16	37
11	48	56	10	.....	.....	3.8	.....	2.5	43	8.0	19	64
12	82	42	10	.....	.....	3.8	.....	3.8	23	5.9	8.0	37
13	37	42	10	.....	3.8	13	.....	23	10	5.9	16	37
14	32	32	10	.....	8.0	37	.....	16	10	5.9	32	32
15	23	27	13	.....	27	10	.....	3.8	19	10	27	42
16	56	27	13	.....	8.0	5.9	.....	2.5	10	10	13	19
17	141	23	23	.....	2.5	5.9	.....	2.5	23	10	19	32
18	42	16	32	.....	2.5	.....	.....	2.5	23	10	19	16
19	32	10	23	.....	2.5	.....	.....	37	10	8.0	43	13
20	27	16	19	.....	27	.....	.....	8.0	16	10	13	13
21	23	16	27	.....	25	.....	10	8.0	250	27	13	16
22	19	16	82	.....	23	.....	2.5	5.9	210	10	13	73
23	19	23	82	.....	21	.....	1.2	10	42	8.0	8.0	43
24	32	37	32	.....	19	.....	1.2	3.8	355	8.0	82	13
25	48	16	373	.....	17	.....	1.2	2.5	64	8.0	48	10
26	32	48	174	.....	15	.....	.7	3.8	82	5.9	91	5.9
27	174	162	.....	.....	13	.....	64	8.0	48	5.9	141	5.9
28	210	37	.....	.....	141	.....	64	.7	32	5.9	37	27
29	56	.....	.....	.....	64	.....	19	.0	23	8.0	27	56
30	37	.....	.....	.....	19	.....	8	13	19	8.0	23	19
31	48	.....	.....	.....	16	.....	3.8	42	.....	8.0	.....	13

NOTE.—Daily discharge computed from a rating curve that is well defined below 75 second-feet. The table shows amount of water passing over the dam below the diversion of the Anahola ditch. Discharge interpolated for period May 21–26, 1911. No records were obtained on the days for which discharge is not given.

Monthly discharge of Anahola River at dam at Kiokala, near Kealia, Kauai, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	92	5.9	27.7	769	B.
1911.					
January	210	8	55.1	3,390	C.
February	610	10	75.0	4,170	C.
March 1–26	373	10	41.3	2,130	C.
May 13–31	141	2.5	23.9	901	C.
June 1–17	37	3.8	9.69	327	B.
July 21–31	64	.7	15.8	345	B.
August	42	.0	6.95	427	A.
September	355	.0	45.0	2,680	B.
October	48	5.9	15.1	928	A.
November	141	8	26.0	1,550	B.
December	82	5.9	28.3	1,740	A.
The period				18,600	

ANAHOLA DITCH AT KIOKALA, NEAR KEALIA, KAUAI.

Anahola ditch diverts water from the south side of Anahola River just below the gaging station, about 5 miles northwest of Kealia.

A 10-foot weir was established on this ditch about one-fourth mile below the intake by the Territorial Public Works Department, May 10, 1909.

A Watson clock register is used for recording the head on the weir.

The leakage from the ditch above this weir is very large, so that the flow recorded is only a part of the amount of water diverted from the stream at the intake.

Discharge measurements of Anahola ditch at Kiokala, near Kealia, Kauai, in 1909–1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1909.					
Dec. 18[a]	W. F. Martin	10.8	5.8	0.24	4.78
1910.					
Nov. 20[a]	do	10.7	6.9	.27	5.4
Dec. 15[b]	Martin and Mendes	3.9	3.4	.....	6.5
17[b]	do	4.2	7.5	1.15	4.69
1911.					
July 21[b]	Martin and Hardy	5.6	12.0	1.48	12.3
Aug. 6[b]	W. V. Hardy	4.0	7.9	1.29	9.2
6[a]	do	11.3	7.4	.31	6.0

[a] Measurement made near Kiokala weir, which is about one-fourth mile below intake of ditch. Gage height is head on 10-foot weir.
[b] Measurement made near intake of ditch. Gage height is from gage near intake.

Daily discharge, in second-feet, of Anahola ditch at Kiokala, near Kealia, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	.....	.....	.....	.....	.....	7.9	15	16	6.7	4.9	16	.....
2	.....	.....	.....	.....	.....	7.3	18	18	6.1	4.1	15	.....
3	.....	.....	.....	.....	.....	9.1	12	17	5.5	5.5	12	.....
4	.....	.....	.....	.....	.....	12	8.8	12	5.8	4.5	10	.....
5	.....	.....	.....	.....	.....	10	12	16	7.9	4.0	9.2	18
6	.....	.....	.....	.....	.....	7.3	12	12	7.0	4.2	8.8	14
7	.....	.....	.....	.....	.....	11	12	11	7.3	4.0	7.9	10
8	.....	.....	.....	.....	.....	8.5	15	10	7.0	3.0	6.7	7.6
9	.....	.....	.....	.....	.....	7.0	17	8.8	11	1.5	7.0	6.4
10	.....	.....	.....	.....	18	9.1	18	8.8	12	2.7	7.3	8.8
11	.....	.....	.....	.....	16	7.6	16	7.9	9.4	2.8	16	7.0
12	.....	.....	.....	.....	15	7.0	19	7.9	6.7	5.0	16	5.5
13	.....	.....	.....	.....	15	6.1	16	11	5.8	18	14	5.3
14	.....	.....	.....	.....	15	5.8	19	13	5.5	16	9.9	5.1
15	.....	.....	.....	.....	15	6.4	17	9.7	5.8	18	8.2	4.8
16	.....	.....	.....	.....	14	7.6	19	7.9	8.2	9.0	7.6	4.8
17	.....	.....	.....	.....	14	9.1	18	8.8	13	6.4	7.0	4.6
18	.....	.....	.....	.....	14	7.3	18	7.3	7.0	5.9	6.4	4.2
19	.....	.....	.....	.....	14	12	18	8.5	8.5	6.0	6.1	4.2
20	.....	.....	.....	.....	16	8.5	20	7.9	6.4	8.0	5.5	4.6
21	.....	.....	.....	.....	14	14	18	7.9	5.5	8.5	5.3	5.1
22	.....	.....	.....	.....	12	15	16	14	5.5	5.4	5.3	4.8
23	.....	.....	.....	.....	12	11	13	9.4	6.1	5.5	5.1	19
24	.....	.....	.....	.....	11	16	13	16	4.5	5.0	5.3	19
25	.....	.....	.....	.....	9.7	10	21	13	4.3	9.4	5.3	20
26	.....	.....	.....	.....	9.1	9.7	18	9.1	4.3	13	6.1	24
27	.....	.....	.....	.....	8.8	9.4	22	8.8	4.5	20	5.1	16
28	.....	.....	.....	.....	11	12	20	10	4.9	23	4.6	10
29	.....	.....	.....	.....	8.8	7.9	20	12	4.9	17	.....	.0
30	.....	.....	.....	.....	8.5	14	18	9.4	7.0	14	.....	.0
31	.....	.....	.....	.....	8.5	.....	18	7.6	.....	16	.....	.0

Daily discharge, in second-feet, of Anahola ditch at Kiokala, near Kealia, Kauai, for 1909–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	0.0	.....	12	12	13	11	.....	7.5	8.5	12	4.0	6.3
2	.0	.....	11	12	12	5.5	.....	10	12	11	.3	5.8
3	.0	.....	12	12	11	1.1	.....	13	7.8	12	.0	5.6
4	.0	.....	12	.....	10	.9	.....	12	8.8	13	.0	5.6
5	4.2	.....	12	.....	10	8.3	.....	9.5	7.0	12	.0	.....
6	10	12	11	.....	13	15	.....	9.4	6.4	12	.0	.....
7	8.8	11	12	.....	14	14	.....	11	7.0	11	4.7	.....
8	9.2	10	11	.....	12	14	.....	9.1	6.2	13	4.8	.....
9	8.5	9.9	9.4	.....	14	14	.....	8.8	6.6	14	.0	.....
10	8.1	12	8.5	5.6	11	13	12	.....	5.8	12	.0	.....
11	.0	13	7.9	5.5	9.2	14	10	.....	9.5	9.8	.0	.....
12	.0	12	7.9	5.4	8.6	15	11	.....	13	13	.0	.....
13	.0	11	8.2	6.1	7.9	14	10	.....	14	15	.0	.....
14	.0	11	9.7	5.2	7.4	14	12	.....	8.8	13	.0	.....
15	.0	11	7.3	5.0	7.3	14	11	.....	7.0	12	.0	.....
16	.0	10	6.7	4.3	10	14	11	.....	10	9.7	.0	.....
17	.0	10	6.1	13	7.9	15	10	.....	11	8.8	.0	.....
18	.0	9.9	5.8	7.6	17	15	13	.....	13	10	.0	4.8
19	3.3	9.5	7.6	7.4	22	14	12	.....	17	11	.0	4.8
20	4.3	9.2	9.7	10	18	14	14	.....	14	8.5	2.5	4.7
21	4.3	9.2	7.6	13	17	14	9.8	14	14	10	5.0	4.6
22	7.5	8.2	6.7	12	15	14	8.8	13	13	11	5.2	4.7
23	8.8	7.6	10	12	.....	13	12	9.1	15	11	5.3	5.3
24	8.5	7.3	9.1	15	.....	16	13	8.0	14	9.0	5.3	5.4
25	8.5	7.6	9.1	17	.....	16	13	14	13	9.0	5.8	3.5
26	8.5	7.9	7.0	14	.....	14	11	13	15	9.5	7.0	.....
27	8.8	8.2	9.1	16	.....	.....	14	10	14	20	5.9	.....
28	8.5	8.8	12	16	.....	.....	16	8.6	13	4.0	7.0	.....
29	8.5	.....	12	15	.5	.....	14	8.5	14	1.9	7.3	.....
30	8.2	.....	11	14	7.0	.....	11	7.6	14	1.7	6.7	.....
31	.....	.....	9.7	.....	11	.....	10	7.0	.....	1.6	.....	.....
1911.												
1	.....	.0	5.8	.....	.....	9.6	.....	7.4	8.7	6.8	5.5	8.0
2	.....	.0	5.6	.....	.....	9.5	.....	7.6	8.1	6.7	5.4	7.6
3	.....	.0	5.5	.....	.....	9.5	.....	7.2	7.5	.1	5.2	7.5
4	.....	.0	5.4	.....	.....	9.5	.....	6.8	8.5	4.1	5.2	8.0
5	.....	0	5.2	.....	.....	.....	.....	6.4	9.0	5.8	6.2	7.6
6	.....	.0	5.2	.....	.....	.....	.....	5.8	7.6	6.3	6.4	8.0
7	.....	.0	5.2	.....	.....	.....	.....	5.7	7.2	3.2	5.2	8.2
8	.0	.0	.....	.....	.....	.....	.....	5.7	6.7	.0	4.9	9.1
9	.0	.0	.....	.....	.....	.....	.....	6.5	7.4	.0	5.5	9.5
10	.0	.0	.....	.....	.....	.....	.....	4.7	10	.0	6.4	8.5
11	.0	.0	.....	.....	.....	.....	.....	7.0	12	.0	7.6	8.0
12	.0	.0	.....	.....	.....	.....	.....	7.6	9.8	.0	6.0	7.5
13	.0	.0	.....	.....	.....	.....	.....	8.5	8.7	.0	7.0	7.6
14	.0	.0	.....	.....	7.5	.....	.....	8.4	8.3	3.4	8.2	7.7
15	.0	.0	.....	.....	8.8	.....	.....	8.5	9.5	6.7	7.9	8.5
16	.0	.0	.....	.....	9.0	.....	.....	7.6	8.5	6.7	7.3	8.2
17	.0	.0	.....	.....	8.2	.....	.....	7.7	9.5	6.8	7.4	8.5
18	.0	3.0	.....	.....	7.1	.....	.....	8.2	10	6.8	7.3	9.5
19	.0	4.5	.....	.....	7.0	.....	.....	8.7	8.6	6.7	8.8	8.9
20	.0	4.7	.....	.....	7.1	.....	.....	7.5	9.0	6.6	7.0	8.8
21	.0	.....	.....	.....	9.2	.....	.....	7.0	18	7.9	7.0	8.4
22	.0	.....	.....	.....	8.0	.....	.....	6.7	17	7.0	7.0	11
23	.0	.....	.....	.....	9.5	.....	.....	6.5	13	6.7	6.4	9.3
24	.0	.....	.....	.....	8.5	.....	.....	8.2	14	6.5	10	8.0
25	.0	.....	.....	.....	7.3	.....	.....	6.5	8.2	6.5	8.8	7.6
26	.0	.....	.....	.....	6.8	.....	.....	5.7	8.2	6.3	12	7.5
27	.0	.....	.....	.....	6.9	.....	.....	6.1	7.6	6.2	13	7.5
28	.0	.....	.....	.....	8.0	.....	.....	6.5	7.0	6.2	10	7.3
29	.0	.....	.....	.....	13	.....	.....	6.1	6.5	6.5	9.1	7.3
30	.0	.....	.....	.....	9.5	.....	.....	10	6.4	6.1	8.6	8.5
31	.0	.....	.....	.....	9.7	.....	7.5	12	.....	5.8	.....	8.2

NOTE.—Daily discharge computed from records of head on a 10-foot weir as obtained by a Watson clock register. No records were obtained on the days for which discharge is not given. The ditch leaks badly between the intake and the weir, a distance of about one-fourth mile. To obtain amount diverted by the ditch at the intake, multiply the discharge by 1.55. This factor is obtained by comparisons of meter measurements at the intake with the weir discharge.

Monthly discharge of Anahola ditch at Kiokala, near Kealia, Kauai, for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
May 10–31	18	8.5	12.7	554
June	16	5.8	9.52	566
July	22	8.8	16.7	1,030
August	16	7.3	10.9	670
September	13	4.3	6.80	405
October	23	1.5	8.72	536
November 1–28	16	4.6	8.52	473
December 5–31	24	.0	8.62	462
The period				4,700
1910.				
January 1–30	10	0.0	4.55	271
February 6–28	13	1.3	9.84	449
March	12	5.8	9.39	577
April 1–3 and 10–30	17	5.0	10.6	505
May 1–22 and 29–31	22	.5	11.4	565
June 1–26	16	.9	12.6	650
July 10–31	16	8.8	11.8	515
August 1–9 and 21–31	14	7.0	10.2	405
September	17	5.8	11.1	660
October	20	1.6	10.4	639
November	7.3	.0	2.56	152
December 1–4 and 18–25	6.3	3.5	5.09	121
The period	22	.0	9.13	5,510
August	12	4.7	7.25	446
September	18	6.4	9.35	556
October	7.9	.0	4.79	295
November	13	4.9	7.41	441
December	11	7.3	8.25	507

ANAHOLA DITCH AT MAKAI WEIR, NEAR KEALIA, KAUAI.

A 10-foot weir was established on Anahola ditch just below the public road by the Territorial Public Works Department, August 11, 1909. The station is about 2½ miles north of Kealia.

A Watson clock register was used for recording the head on the weir.

This station was abandoned early in 1911.

There was some inflow into and diversion from Anahola ditch between the two weir stations. This makes it impossible to use the records for determining the seepage losses.

Discharge measurements of Anahola ditch at Makai weir, near Kealia, Kauai, 1909–10.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 18	W. F. Martin	3.5	2.92	0.25	4.54
18	.....do	3.5	2.92	.25	4.34
1910.					
Dec. 8	W. F. Martin	4.2	5.1	.42	11.1

NOTE.—Gage heights are readings of head on 10-foot weir.

Daily discharge, in second-feet, of Anahola ditch at Makai weir, near Kealia, Kauai, for 1909–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1					12	9.0	11	12	6.3	4.9	12	7.6
2					14	8.4	11	12	6.0	4.0	12	16
3					11	9.0	11	12	5.4	4.5	10	7.6
4					10	10	9.0	10	5.4	5.0	9.1	6.7
5					7.8	10	9.6	11	6.1	4.7	8.5	11
6					2.2	8.8	9.8	11	6.7	4.2	7.9	10
7					3.3	10	9.6	9.3	6.4	4.1	7.3	9.0
8					9.8	9.4	9.9	9.0	6.4	3.9	7.0	8.0
9					12	8.5	12	8.6	7.3	3.7	6.1	7.0
10					16	8.9	13	8.6	9.0	3.9	6.1	6.0
11				14	16	8.9	12	7.8	8.2	3.8	8.5	5.0
12				14	15	8.0	14	7.4	6.7	3.7	10	5.3
13				13	14	7.6	12	6.4	7.6	3.6	11	5.1
14				13	14	7.0	13	9.4	6.4	9.7	8.8	4.9
15				12	13	7.2	13	7.6	7.4	11	7.9	4.7
16				12	14	7.7	13	8.6	6.8	11	7.3	4.7
17				12	13	8.6	13	7.2	7.0	9.1	6.7	4.7
18				12	13	7.9	14	6.8	7.1	6.2	6.4	4.5
19				12	13	9.0	14	6.7	7.0	5.8	6.1	4.3
20				11	14	9.2	15	6.1	6.4	5.6	5.5	3.8
21				10	13	10	13	5.9	6.2	6.1	5.3	4.7
22				9.6	12	12	12	7.4	5.6	7.0	5.1	4.7
23				8.7	12	10	11	7.9	5.9	5.4	4.9	7.2
24				8.9	11	12	10	9.5	5.5	5.2	4.9	7.9
25				8.7	11	10	14	10.0	4.7	6.4	4.9	8.5
26				8.0	10	9.6	14	6.6	4.4	8.2	5.3	10
27				8.7	10	8.8	15	7.6	4.5	11	4.9	9.4
28				9.1	11	9.9	15	8.1	4.7	14	4.7	8.8
29				9.4	10	8.6	15	9.0	4.5	12	4.7	2.0
30				12	9.4	8.8	3.5	8.2	5.5	12	5.5	3.0
31					9.6		4.0	7.0		13		6.1
1910.												
1	5.4	8.1	8.4	6.8	8.8	8.2		7.8	5.2	7.2	1.0	7.1
2	5.3	8.1	9.0	6.8	8.8	8.2		7.3	6.0	7.0	1.2	7.0
3	4.9	8.1	8.7	7.0	8.6	8.2		7.1	5.5	7.0	1.2	7.3
4	5.7	8.1	8.4	6.8	8.4	8.2		7.3	5.6	7.4	1.4	7.7
5	6.8	8.1	8.4	6.4	8.2	8.2		8.4	5.3	7.4	1.3	7.7
6	3.2	8.4	8.6	6.1	8.1	8.1		8.4	5.0	6.7	1.0	8.2
7	1.4	8.7	8.7	6.4	9.1	7.9		7.6	4.9	6.8	1.3	7.6
8	2.0	8.4	8.7	6.1	8.8	7.9		7.6	4.9	7.0	1.1	8.5
9	2.2	8.4	8.6	5.7	8.8	8.5		7.2	5.0	7.6	4.8	8.8
10	2.5	9.0	7.9	5.4	7.9	8.5	8.3	7.3	4.7	7.4	2.0	8.6
11	3.2	9.6	7.4	5.2	7.1	9.1	8.0	6.9	4.8	6.7	5.7	8.8
12	3.0	10	7.4	5.1	6.4	8.6	8.6	6.3	5.5	6.7	6.8	8.5
13	3.0	10	7.5	5.1	6.5	8.8	8.5	5.8	5.6	7.6	6.8	8.5
14	3.0	9.6	7.8	4.5	6.4		7.8	5.5	5.3	7.6	7.0	8.4
15	3.0	9.3	7.4	4.4	6.2		7.6	5.5	5.0	7.0	6.5	8.1
16	3.2	9.0	7.0	4.4	6.7		8.2	5.5	4.9	6.8	6.8	7.9
17	3.0	8.7	6.6	5.3	5.8		8.4	5.5	5.3	6.4	6.8	7.9
18	3.0	8.7	6.3	5.9	6.7		9.0	5.5	5.6	6.4	6.8	7.9
19	4.6	8.4	6.6	5.8	8.2		8.8	5.1	3.4	6.3	7.0	7.8
20	6.8	8.5	7.3	6.7	7.9		9.0	5.3	.1	6.5	7.0	7.9
21	6.6	8.7	7.0	7.3	8.2		7.9	6.5	.9	6.5	7.6	7.7
22	7.1	8.7	6.3	7.1	8.0		7.9	6.7	5.5	6.2	8.0	7.7
23	8.7	8.7	6.4	7.0	8.4		7.9	6.2	7.3	6.7	7.9	8.8
24	8.7	8.1	6.8	8.4	8.0		8.6	5.8	7.4	6.7	7.6	8.8
25	9.0	8.1	6.8	10	7.3		8.6	6.2	7.2	6.4	7.3	9.4
26	9.0	7.8	6.1	8.6	7.0		8.0	7.0	7.9	6.1	7.2	
27	9.0	8.1	6.2	8.7	6.7		8.6	6.6	8.0	6.9	7.4	
28	9.0	8.1	7.1	8.7	6.4		8.7	6.4	7.9	1.5	7.1	
29	8.4		7.1	8.7	7.0		8.8	6.0	7.9	.3	7.1	
30	8.4		7.1	8.7	8.2		8.4	5.8	7.9	.2	7.1	
31	8.4		7.0		7.9		8.0	5.4		.5		

Daily discharge, in second-feet, of Anahola ditch at Makai weir, near Kealia, Kauai, for 1909–1911—Continued.

Day.	Jan.	Day.	Jan.	Day.	Jan.
1911.		1911.		1911.	
15	1.5	20	0.5	25	0.4
16	1.3	21	.7	26	.4
17	1.5	22	.5	27	.5
18	.9	23	.4	28	.5
19	.4	24	.4	29	.4

NOTE.—Daily discharge computed from records of head on a 10-foot weir as obtained by a Watson clock register. No records were obtained on the days for which discharge is not given.

Monthly discharge of Anahola ditch at Makai weir, near Kealia, Kauai, for 1909–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
April 11–30	14	8.0	10.9	432
May	16	2.2	11.5	707
June	12	7.0	9.09	541
July	15	3.5	11.8	726
August	12	5.9	8.54	525
September	13	4.4	6.24	371
October	14	3.6	6.86	422
November	12	4.7	7.15	425
December	16	2.0	6.72	413
The period				4,560
1910.				
January	9.0	1.4	5.40	332
February	10	8.1	8.62	479
March	9.0	6.1	7.44	457
April	10	4.4	6.64	395
May	9.1	5.8	7.63	469
June 1–13	9.1	7.9	8.34	215
July 10–31	9.0	7.6	8.35	364
August	8.4	5.1	6.50	400
September	8.0	.1	5.52	328
October	7.6	.2	6.05	372
November	8.0	1.0	5.26	313
December 1–25	9.4	7.0	8.10	402
The period	10	.1	6.85	4,530
1911.				
January 15–29	1.5	.4	.69	20.5

HANALEI RIVER BASIN.

GENERAL FEATURES.

Hanalei River basin lies on the northern slope of Kauai, west of Kalihiwai basin and east of Lumahai basin. It is 9 or 10 miles long north and south, and from 1 to 1½ miles wide in the lower part of the basin, and about 3½ miles in the upper part. The total area is about 25 square miles. The upper part of the basin is contiguous to upper Wainiha basin on the west, and northern Wailua basin on the southeast. The lower part of the basin opens out into a broad picturesque valley which extends several miles from Hanalei Bay. The stream through the valley has a very light grade and is navi-

gable for small craft. Numerous tributaries join the stream from the east and west.

The rainfall averages about 100 inches at the mouth of Hanalei River, and is probably as much as 300 or 400 inches at its source on the northern slope of Waialeale.

Water is diverted from Hanalei River through China and Kuna ditches for rice irrigation.

Gaging stations have been established on Hanalei River and on China and Kuna ditches.

HANALEI RIVER NEAR HANALEI, KAUAI.

A gaging station was established on Hanalei River at a point about 5 miles above its mouth December 28, 1911. The station is below the intake of China ditch and above the intake of Kuna ditch.

A staff gage, graduated in tenths of feet from 5 to 19 feet, is fastened to a mango tree on the left bank of the stream. A cable 172 feet in length with car is used for making the measurements. The stream is wide and has a probable range in stage of 6 or 8 feet.

Discharge at this point, with the addition of the flow of China ditch, gives the total flow of Hanalei River.

Discharge measurements of Hanalei River near Hanalei, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 31	W. V. Hardy	135	128	6.58	164

NOTE.—Measurement made by wading 20 feet below gage.

CHINA DITCH.

China ditch diverts water from the left side of Hanalei River, a short distance above the gaging station on the river. The gaging station was established at a point opposite the river station December 28, 1911.

The gage is graduated to tenths of feet and a footbridge is used for making the measurements.

Records at this station show the amount of water diverted from Hanalei River for rice irrigation on the west side.

Discharge measurements of China ditch near Hanalei, Kauai, 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 31	W. V. Hardy	6.5	14.6	3.4	15.1

NOTE.—Measurement made from bridge at gage.

WAINIHA RIVER BASIN.

GENERAL FEATURES.

Wainiha River basin lies on the northern slope of Kauai. It is a long, narrow basin, its width being 1 mile to 2½ miles and its length approximately 12 miles. The total area of the basin is about 20 square miles. It lies west of Lumahai and northeast of Olokele and Waimea basins.

Wainiha River rises at the summit of Waialeale and flows northwestward and then northeastward to the sea. It receives numerous small tributaries from each side. Probably some of these tributaries from the west side are really springs receiving some of their water from the Alakai Swamp which lies above them to the southwest. Rainfall is about 100 inches at the mouth of Wainiha River, 170 inches at elevation 700 feet, and probably 300 or 400 inches near its source.

Water is diverted from the west side of the stream through Wainiha canal and is used for power development. Below the power house, which is at an elevation of 100 feet, water is diverted for taro irrigation on both sides of the stream.

Gaging stations have been established on Wainiha River below the power house and on Wainiha canal.

WAINIHA RIVER AT POWER HOUSE, NEAR WAINIHA, KAUAI.

A gaging station was established on Wainiha River about 500 feet below the power house of the Kauai Electric Co. and about 2 miles from Wainiha, December 30, 1911.

A staff gage, in two sections, is fastened on the left bank. It is graduated in tenths of a foot from 4 to 11 feet. A wire suspension bridge 184 feet in length is used for making measurements. The stream at this point runs in two channels, so that a gage and bridge had to be placed on each. The main flow, however, is through the west channel, which is about 100 feet wide and in which the range in stage is probably 5 or 6 feet.

Discharge measurements of Wainiha River at power house, near Wainiha, Kauai, 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 30[a]	W. V. Hardy	145	290	[b] 5.8	238

[a] Measurement made from wagon bridge on Government road about 1½ miles below station.
[b] Reading of gage on west channel.

WAINIHA CANAL AT INTAKE, NEAR WAINIHA, KAUAI.

The Kauai Electric Co. has kept a gage on the Wainiha canal at the intake for several years, but has not kept a record of gage heights until recently. It has furnished the Geological Survey with all gage-height readings made during 1910 and 1911, and these will be used to determine the daily discharge from a current-meter rating at the gage.

The discharge at this point shows the amount of water diverted from Wainiha River at elevation 700 feet for power purposes.

Discharge measurements of Wainiha canal at intake, near Wainiha, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 24	Martin and Hardy	8.5	33.1	4.71	93

Daily gage height, in feet, of Wainiha canal at intake, near Wainiha, Kauai, for 1910–11.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.						1910.					
1	4.55	4.00	4.95	4.05	2.60	16	4.68	4.95	4.40	3.38	2.60
2	4.40	3.95	4.95	1.00	2.60	17	4.30	4.15	4.05	3.22	2.60
3	4.62	3.95	4.95	1.00	2.60	18	4.20	3.85	3.85	3.10	2.60
4	4.70	4.88	4.90	1.00	2.60	19	4.15	4.05	3.62	3.10	3.20
5	4.80	4.00	4.72	1.00	2.60	20	4.48	4.78	3.90	3.10	3.30
6	4.90	4.85	4.30	1.00	2.60	21	4.95	4.95	4.38	3.40	3.30
7	4.92	4.62	4.58	1.00	2.60	22	4.95	4.78	4.95	3.65	3.20
8	4.88	3.95	4.95	1.00	2.60	23	4.82	4.95	4.95	4.50	4.50
9	4.95	4.42	4.95	1.00	2.60	24	4.35	4.62	4.68	4.50	4.50
10	4.92	4.10	4.95	1.00	2.60	25	4.92	4.92	4.05	4.55	4.50
11	4.75	3.85	4.95	1.00	2.60	26	4.95	4.95	3.80	2.60	2.25
12	4.60	4.38	4.95	1.00	2.60	27	4.95	4.95	4.95	2.60	2.00
13	4.40	4.58	4.95	1.00	2.60	28	4.95	4.95	4.65	1.00	2.00
14	4.78	4.00	4.92	1.00	2.60	29	4.92	4.95	4.65	1.80	2.00
15	4.80	4.42	4.50	3.40	2.60	30	4.50	4.95	4.55	2.60	2.00
						31	4.05	.....	4.45	.....	2.00

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.50	2.20	2.20	2.20	3.80	4.60	4.70	4.30	4.65	2.00	3.60	4.20
2	1.65	.00	2.20	2.20	3.80	4.60	4.70	4.25	4.15	4.65	3.65	4.05
3	2.75	.00	2.20	2.20	3.80	4.60	4.70	4.70	4.00	4.60	3.60	3.95
4	2.35	.00	2.20	2.20	3.80	4.60	4.70	4.25	3.85	4.70	3.55	4.45
5	2.35	2.20	2.20	2.20	3.80	4.60	4.70	3.95	4.55	4.70	4.60	4.45
6	2.35	2.20	2.20	2.20	3.80	4.60	4.70	3.90	4.50	4.70	4.45	4.70
7	2.35	2.20	2.20	3.75	3.80	4.60	4.70	3.90	4.55	4.70	4.55	4.70
8	2.35	2.20	2.20	3.80	4.60	4.60	4.70	4.15	4.70	4.70	4.70	4.70
9	2.35	2.20	2.20	3.80	4.60	4.60	4.50	4.40	4.70	4.45	4.70	4.70
10	2.35	2.20	2.20	3.80	4.60	4.60	4.70	4.70	4.70	4.25	4.70	3.00
11	2.35	2.20	2.20	3.80	4.60	4.60	4.70	4.45	4.70	4.05	4.70	3.00
12	2.35	2.20	2.20	3.80	4.60	4.60	4.70	4.45	4.70	4.05	4.50	3.00
13	2.35	2.20	2.20	3.80	4.60	4.60	4.70	4.65	4.70	4.00	4.70	3.00
14	2.35	2.20	2.20	3.80	4.60	4.60	4.70	4.70	4.60	4.00	4.70	3.00
15	2.35	2.20	2.20	3.80	4.60	4.60	4.50	4.70	4.70	3.85	4.70	3.00
16	2.15	2.20	2.20	3.80	4.60	4.60	4.40	4.60	4.70	3.80	4.70	3.00
17	2.15	2.20	2.20	3.80	4.60	4.60	4.70	4.70	4.70	4.05	4.70	3.00
18	2.15	2.20	2.20	3.80	4.60	4.50	4.40	4.70	4.70	4.10	4.70	3.00
19	2.15	2.20	2.20	3.80	4.60	4.45	4.50	4.65	4.70	3.85	4.70	3.00
20	2.15	2.20	2.20	4.10	4.60	4.60	4.70	4.70	4.70	3.80	4.70	3.00
21	2.15	2.20	2.20	4.40	4.60	4.65	4.70	4.35	1.70	3.85	4.70	3.00
22	2.15	2.20	2.20	4.40	4.60	4.70	4.70	3.95	1.70	3.80	4.70	3.00
23	2.15	2.20	2.20	3.60	4.60	4.70	4.70	3.85	1.70	3.90	4.70	3.00
24	2.15	2.20	2.20	3.40	4.60	4.70	4.70	4.00	1.70	4.70	4.70	3.00
25	2.15	2.20	2.20	3.40	4.45	4.70	4.45	3.90	1.70	4.45	4.70	3.00
26	2.15	2.20	2.20	3.40	4.50	4.70	4.15	4.55	1.70	4.10	4.60	3.00
27	2.15	2.20	2.20	3.40	4.60	4.70	4.60	4.70	1.70	3.85	4.70	3.00
28	2.15	2.20	2.20	3.40	4.60	4.70	4.70	4.10	1.70	3.70	4.70	3.00
29	2.15	.....	2.20	3.40	4.60	4.70	4.70	3.85	1.70	3.80	4.70	3.00
30	2.15	.....	2.20	3.40	4.60	4.70	4.35	4.70	1.70	3.75	4.60	3.00
31	2.15	.....	2.20	.....	4.60	.....	4.25	4.70	.....	3.80	.....	3.00

NOTE.—The discharge will be published later, when sufficient measurements for a rating have been made. Gage height is the mean of two readings daily, taken at 7 a. m. and 6 p. m.

WAINIHA CANAL AT TUNNEL NO. 18, NEAR WAINIHA, KAUAI.

The Kauai Electric Co. established a gage on Wainiha canal at tunnel No. 18 about 1¼ miles below the intake. The ditch at this point has received the inflow from several tributaries of Wainiha River.

The gage-height record was begun in 1911. The data have been furnished to the Geological Survey by the company and have been used to determine the daily discharge of the ditch from a current-meter rating of the section.

Discharge measurements of Wainiha canal at tunnel No. 18, near Wainiha, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 25	Martin and Hardy	8.8	29.3	4.28	105

NOTE.—Several measurements made early in 1912 were used in determining the rating.

Daily gage height, in feet, of Wainiha canal at tunnel No. 18, near Wainiha, Kauai, for 1911.

[A. Menefoglio, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.1	4.2	2.4	4.2	3.95	16	4.4	4.4	4.0	4.3	3.0
2	4.1	3.8	4.3	4.2	3.75	17	4.4	4.4	3.8	4.3	3.0
3	4.4	3.7	4.4	4.2	3.75	18	4.4	4.4	3.8	4.3	3.0
4	4.05	3.6	4.3	4.2	4.15	19	4.3	4.4	3.7	4.3	3.0
5	3.75	4.3	4.3	4.2	4.15	20	4.4	4.5	3.7	4.3	3.0
6	3.7	4.4	4.3	4.0	4.3	21	4.05	.....	3.7	4.4	3.0
7	3.8	4.4	4.3	4.3	4.3	22	3.7	.....	3.8	4.3	3.0
8	3.9	4.4	4.3	4.3	4.3	23	3.65	.....	4.3	4.3	3.0
9	4.05	4.4	3.9	4.3	4.3	24	3.8	.....	4.2	4.3	3.0
10	4.3	4.4	3.9	4.3	3.0	25	3.7	.....	4.2	4.3	3.0
11	4.2	4.4	3.9	4.3	3.0	26	4.3	.....	4.2	4.2	3.0
12	4.15	4.4	3.7	4.2	3.0	27	4.4	.....	4.2	4.4	3.0
13	4.25	4.4	3.8	4.3	3.0	28	3.8	.....	4.2	4.3	3.0
14	4.4	4.4	3.7	4.3	3.0	29	3.65	.....	4.2	4.3	3.0
15	4.4	4.3	3.6	4.3	3.0	30	4.5	.....	4.2	4.1	3.0
						31	4.3	.....	4.2	.....	3.0

NOTE.—The gage height is the mean of two readings taken at 7 a. m. and 6 p. m., furnished by the Kauai Electric Co. Records missing for the period Sept. 21–30.

Daily discharge, in second-feet, of Wainiha canal at tunnel No. 18, near Wainiha, Kauai, for 1911.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	94	98	35	98	88	16	106	106	90	102	53
2	94	82	102	98	80	17	106	106	82	102	53
3	106	78	106	98	80	18	106	106	82	102	53
4	92	74	102	98	96	19	102	106	78	102	53
5	80	102	102	98	96	20	106	110	78	102	53
6	78	106	102	90	102	21	92	.....	78	106	53
7	82	106	102	102	102	22	78	.....	82	102	53
8	86	106	102	102	102	23	76	.....	102	102	53
9	92	106	86	102	102	24	82	.....	98	102	53
10	102	106	86	102	53	25	78	.....	98	102	53
11	98	106	86	102	53	26	102	.....	98	98	53
12	96	106	78	98	53	27	106	.....	98	106	53
13	100	106	82	102	53	28	82	.....	98	102	53
14	106	106	78	102	53	29	76	.....	98	102	53
15	106	102	74	102	53	30	110	.....	98	94	53
						31	102	.....	98	.....	53

NOTE.—Daily discharge computed from a rating curve that is well defined between 60 and 110 second-feet.

Monthly discharge of Wainiha canal at tunnel No. 18, near Wainiha, Kauai, for Aug. 1 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August	110	76	94.3	5,800	A.
Sept. 1–20	110	74	101	4,010	A.
October	106	35	89.6	5,510	A.
November	106	90	101	6,010	A.
December	102	53	65.0	4,000	B.

WAINIHA CANAL AT TAILRACE, NEAR WAINIHA, KAUAI.

The Kauai Electric Co. established a gage in the tailrace at the power house and kept a record of gage heights for the month of December, 1911. These records have been given to the Geological Survey and, when sufficient measurements have been made for a rating, will be useful in showing the amount of water actually used for power development by the Kauai Electric Co.

Discharge measurements of Wainiha canal at tailrace, near Wainiha, Kauai, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 25	Martin and Hardy	10.0	23	2.30	107

Daily gage height, in feet, of Wainiha canal at tailrace, near Wainiha, Kauai, for December, 1911.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1	2.30	11	1.40	21	2.00
2	2.30	12	1.40	22	2.00
3	2.25	13	1.40	23	2.00
4	2.30	14	1.10	24	1.45
5	2.15	15	1.50	25	1.20
6	2.15	16	1.00	26	2.10
7	2.10	17	.70	27	2.05
8	2.10	18	.85	28	2.10
9	1.75	19	.80	29	2.10
10	1.45	20	1.55	30	2.05
				31	1.20

NOTE.—Discharge will be published later, when sufficient measurements for a rating have been made. The gage height is the mean of two readings daily, taken at 7 a. m. and 6 p. m.

MISCELLANEOUS MEASUREMENTS ON KAUAI.

The following miscellaneous discharge measurements have been made on the streams and ditches of Kauai during 1909–1911. They are arranged by the stream basins in counter-clockwise order, beginning at the west.

Miscellaneous measurements on streams, island of Kauai, in 1911.

Date.	Stream.	Tributary to—	Locality.	Discharge.
1911.				*Sec.-ft.*
Sept. 9	Kauaikanana	Poomau Stream	About 200 feet above trail crossing	3.83
9	Kokee	Waimea River	Knudsen's camp, Kokee Flat	.45
9	Halemanu	do	Road crossing near Knudsen's mountain house.	.10
Oct. 19	Waimea	Pacific Ocean	About 80 feet above confluence with Koaie Stream.	19.7
19	Koaie	Waimea River	About 75 feet above confluence with Waimea River.	19.2
Apr. 26	Unnamed	Waialae Stream	Trail crossing near Waialae gaging station.	1.45
Sept. 12	do	do	do	.41
12	North Fork	Lali Stream	Trail crossing	.24
Apr. 26	Lali	Waialae Stream	Trail crossing about 300 feet from Gay's mountain house.	1.85
Sept. 13	do	do	do	.14
Oct. 19	Waialae	Waimea River	About 300 feet above confluence with Waimea River.	4.63
Sept. 13	Kalehuahakihaki	Mokihana Stream	Trail crossing about ¼ mile south of Gay's mountain house.	.11
11	Kakekapoeleele	do	Trail crossing	.68
Apr. 26	Mokihana	Waimea River	do	7.3
Sept. 14	do	do	do	.63
Sept. 11	Koholoina	Halekua Stream	Just above confluence with Halekua Stream.	.50
11	Halekua	Olokele River	About ¼ mile below Koholoina Stream.	3.68
May 1	Manuahi	Hanapepe River	Above confluence with Hanapepe River.	4.8
Aug. 29	North Fork	Konohiki Stream		.14
29	East Branch	do		*a* .5
18	Maiakii	Waiawaawa Reservoir.	About ¼ mile above Waiawaawa Reservoir.	3.42
9	Kapaa	Pacific Ocean	About 60 feet above confluence with Kealia Stream.	9.2
9	Kealia	Kapaa River	About 40 feet above confluence with Kapaa Stream.	7.8
9	Kapaa	Pacific Ocean	About ½ mile below confluence of Kealia and Kapaa streams.	*b* 15.5
13	Keaoopu	Anahola River	About 200 feet above confluence with Anahola River.	3.08
13	Anahola	Pacific Ocean	About 100 feet above Keaoopu Stream	8.6
July 23	Kalihiwai	do	½ mile above Kalihiwai village	47.9
Dec. 30	Waioli	do	Highway bridge near Hanalei	52.0
30	Waipa	do	100 feet below highway bridge	8.0
30	Waikoko	do	30 feet below highway bridge	3.99
July 24	No. 8 tributary	Wainiha canal	Outlet into Wainiha canal	9.0
24	No. 7 tributary	do	do	5.0

a Estimated.
b Small taro-ditch taking out on north side of stream not included in this measurement.

Miscellaneous measurements on ditches, island of Kauai, in 1909–1911.

Date.	Ditch.	Diversion from—	Locality.	Discharge.
1909.				*Sec.-ft.*
Dec. 17	Kapahi	Kapaa River		[a] 12.3
1910.				
Nov. 11	Kekaha	Waimea River	Tunnel No. 2	81
1911.				
Apr. 27	Kekaha	Waimea River	Flume No. 1, ⅛ mile below intake	91
27	do	do	Flume No. 2, 1 mile below intake	88
27	do	do	Camp No. 2, 1½ miles below intake	86
27	do	do	Above tunnel No. 7	83
28	do	do	Mouth of tunnel No. 10	78
Oct. 20	do	do	50 feet above Huekipo weir	[b] 31.9
20	do	do	Huluhulunui bridge, 4,000 feet below Huekipo.	30.6
Nov. 7	do	do	do	29.8
7	do	do	Waiaka bridge, 2,000 feet below Huluhulunui.	26.6
7	First gate, field No. 28, Waimea side.	Kekaha ditch	Between Huluhulunui bridge and Waiaka bridge.	[c] 1.54
7	Second gate, field No. 28, Mana side.	do	do	[d] .74
10	Kekaha	Waimea River	Huluhulunui bridge	34.3
10	do	do	Waiaka bridge	[e] 34.3
Feb. 14	do	do	Pump No. 3	[f] 62
Apr. 28	do	do	do	[g] 66
Nov. 4	Eneamo	do	50 feet below intake, near Kekaha ditch siphon.	1.23
July 27	Olokele	Olokele River	West end of tunnel No. 31	56
27	Field B supply	Olokele ditch	Near main Olokele ditch	8.9
27	Olokele	Olokele River	West end of tunnel No. 36	43
27	do	do	East end of tunnel No. 36	44
May 2	Hanapepe	Hanapepe River	Flume No. 8	55.4
2	do	do	Below new tunnel	54.2
2	do	do	500 feet above Makai siphon	[h] 55.6
3	McBryde		At weir on road	[i] 6.0
Aug. 15	Rice		Near Kapaa	2.29
Aug. 14	Tunnel	Kapahi ditch	Lower end of tunnel above reservoir	11.4
14	Kapahi	Kapaa River	Below outflow to tunnel ditch	[j] 14.4
13	Power	Kealia River	At intake	7.2
18	do	do	do	7.5
18	do	do	About 300 feet above Waiawaawa reservoir.	5.2
18	Kaneha	do	About 100 feet below intake	5.6
July 24	Wainiha	Wainiha River	Gage No. 7	[k] 102

[a] Discharge by weir was 11.2 second-feet.
[b] Discharge by 6-foot weir was 28.7 second-feet.
[c] For irrigating cane, "Two men's water."
[d] For irrigating cane, "One man's water."
[e] Second gate, field No. 28, closed. One diversion of about 1.54 second-feet at first gate. Water raised 0.12 foot while this measurement was being made.
[f] Discharge by 6-foot weir was 65.6 second-feet.
[g] Discharge by 6-foot weir was 67.5 second-feet.
[h] Water raised in ditch due to increase at intake.
[i] Discharge by 6-foot weir was 5.6 second-feet.
[j] Water in ditch fell 0.04 foot during measurement.
[k] Gage height 4.40 feet.

PUMPED WATER ON KAUAI.

Several small pumping plants on Kauai are used for pumping underground water for irrigation at very dry times or to lift fresh water to higher elevations. At only one place, however, is pumped water from underground sources depended upon as a regular irrigation supply.

The McBryde Sugar Co. has five electric plants with seven pumps and two steam plants with two pumps which are used for pumping underground water from Hanapepe and Lawai valleys.

During 1911, the quantity of water pumped daily by this company averaged 19.7 million gallons, or 30.4 second-feet. A large part of this water is lifted more than 400 feet.

ISLAND OF OAHU.

GENERAL FEATURES.

The island of Oahu lies midway between Kauai on the northwest and Maui on the southeast. It is separated from Kauai by Kaieie Waho Channel (width 63 miles) and from Molokai, which lies between Oahu and Maui, by Kaiwi Channel (width 23 miles). It is 2,100 miles southwest of San Francisco in latitude 21° 30′ north and longitude 158° west. It is somewhat north of the geographic center of the main group, and is third in size, but it is preeminently the most important member of the group. (See Pl. XII, at end of volume.)

In shape Oahu is somewhat trapezoidal. The bases of the trapezoid are at the northeast and the southwest, and the legs are at the south and the northwest, the latter being at right angles to the base. The longer base is about 37 miles long; the shorter, about 22 miles. The legs at the south and northwest are about 29 and 22 miles in length respectively. The shortest distance across the tableland from Kaiaka Bay at the north to Pearl Lochs at the south, which extend 5 miles inland, is about 15½ miles. The total area of Oahu is 598 square miles, as compared with 4,015 square miles for Hawaii and 728 for Maui.

Oahu Island has two distinct mountain ranges, a feature which makes it unique as compared with the other islands, none of which has any distinct mountain range. The Koolau Range at the northeast extends the full length of the island, the crest being approximately parallel to the shore and only 3 or 4 miles inland. The Waianae Range extends almost the entire length of the southwest side, the crest being from 1 to 5 miles from the shore. These ranges are separated by a tableland which rises to an elevation of 800 feet in the saddle near the center of the island, from which point it slopes gently downward to the north and to the south. Both these ranges are at right angles to the northeast trade winds which blow for about nine months of the year, and both are exposed more or less to the severe southwestern storms, or konas, which prevail at times. Each shields the other to a greater or less extent, and this helps to explain some of the present physical features.

The Waianae Mountains are very much older than the Koolau Mountains. They are probably as old as Kauai, and originally formed a single island much larger and higher than the present Waianae Mountains. Erosion had probably eaten deeply into the northeastern and southwestern slopes and completely obliterated all trace of the original crater long before the Koolau Mountains on the east had emerged from the ocean. The successive lava flows from younger Koolau then piled up along the eastern base of Waianae,

filling the valleys and covering the ridges, thus obliterating the effects of earlier channeling on that side. On the southwest side, however, nothing of the kind has occurred. The original valleys have been broadened, deepened, and extended farther into the heart of the mountains where they terminate in almost vertical corrugated walls, Lualualei, Waianae, and Makaha are the most prominent of these valleys. Kaala Peak, back of Waianae Valley, elevation 4,030 feet, is the highest point on Oahu.

The Koolau Mountains came into being long after the Waianae Mountains. They were built up by successive lava flows which, on the west, overlapped the eastern slopes of Waianae and filled up its valleys. As soon as the Koolau Range had reached a sufficient height it formed a wind barrier in the path of the trades, which largely robbed the clouds of their moisture before they reached the Waianae Mountains, so that thereafter the rainfall in these mountains became much less, with the result that the denuding agencies also became less active. The Koolau Range not only protects the Waianae Mountains on the west but is in turn shielded by them from the severe kona storms that come from the southwest. The extent of this protection is well shown by the great difference in erosion on the western and southern slopes of the Koolau Mountains. On the south the slopes are unprotected, with the result that deep, broad valleys, such as Palolo, Manoa, Nuuanu, and Kalihi, all back of Honolulu, have eaten their way into the very core of the range. Indeed, Nuuanu and Kalihi have cut through the core forming the low pass at the head of each valley.

The eastern side of Koolau Range is very much unlike the western side. It is divided into two parts by the Kualoa Ridge, or spur, which juts out from the middle of the main range as a sort of headland north of Waikane. North of Kualoa are several deep valleys which extend well back into the range and are separated from each other by spur ridges that branch off from the main range. These valleys and ridges have probably resulted entirely from erosion. South of Kualoa the spur ridges separating the different valleys are almost entirely wanting. The result is that the heads of the various short alcove valleys form an almost continuous corrugated wall or precipice, 3 or 4 miles from shore, 1,000 to 1,200 feet high and 10 or 12 miles long. The area between the sea and the base of the cliffs is comparatively open rolling country across which short streams course to the sea. The existing cliff forms may be due entirely to erosion, as maintained by some authorities, wholly subaerial or partly submarine, or they may have originated in a long fissure, as suggested by Dana,[1] which resulted in the mass east of the rupture sliding into the sea. As

[1]Dana, J. D., Characteristics of volcanoes, 1890, p. 288.

bearing on Dana's theory, it is interesting to note that practically all the streams south of Kualoa seem to originate in constant high level springs which are about 1,000 feet above the sea back of Waikane and Waiahole and decrease in elevation toward the south. These springs appear to emerge from porous strata overlying an impervious stratum which dips gently to the south and probably to the west away from the face of the cliff.

The shore line of Oahu is much more irregular than the shore line of any of the other islands. There are important points on all sides of the island, the most prominent of which are Diamond and Koko heads, Makapuu, Mokapu, Kahuku, Kaena, and Barbers points. There are also good bays, the most important of which are at Honolulu and Pearl harbors on the south side. Pearl Lochs, 6 or 7 miles west of Honolulu, is the site of the naval station and is said to form one of the safest and best harbors on the Pacific.

Oahu has more coral on and around it than any of the other islands. Extensive living coral reefs almost completely girdle the island, closing the entrance to the bays except where enough fresh water is received from streams or springs to maintain an opening to the sea. The coastal plain which extends almost entirely around the island consists mainly of uplifted coral, especially on the south side; and coralline limestone strata are encountered in well borings at various depths below sea level.

The distribution of coral below and above sea level is one of the principal evidences of long periods of subsidence followed by later upheaval. Well borings show alterations of basalt clay, earth, limestone, and hard basaltic sheets to a depth of several hundred feet. Hard coral has been encountered at 800 feet below sea level, and broken coral at somewhat greater depth. These facts lead to the conclusion that the island has been depressed 700 or 800 feet. Surface coral near the shore indicates a later upheaval of 50 feet or more. At Waipio, just west of Pearl City, there is a stratum of oyster shells 3 or 4 feet thick and probably 20 feet or more above sea level.

The conditions just described have given to Oahu the distinction of having the best artesian water supply of any of the islands. The principal water-bearing stratum is a vesiculated basalt which lies 300 to 400 feet below sea level and which is overlain by an impervious cover. The water in flowing wells originally reached 42 feet above sea level at Honolulu, 32 feet at Ewa, and 26 feet at Kahuku. The height is now considerably less than it was originally. In addition to the large number of flowing wells, there are many others which are pumped. In all nearly 500 wells have been sunk on Oahu, chiefly on the south side.

The rainfall on Oahu is comparatively less than on the other large islands. It ranges from 31 inches a year in the business center of

Honolulu to 21 inches at Ewa and Waianae, all on the south side. On the mauka side of Honolulu City the rainfall ranges from 40 or 50 inches to 90 inches just back of the city. The rainfall reaches 140 or 150 inches in Nuuanu and Manoa valleys, but is considerably less on the mountains. On the windward side of the island the rainfall is less than 100 inches. It probably does not exceed 100 inches on an average anywhere on the Koolau Range. On the Waianae Range the rainfall is light.

The forest cover is restricted largely to the higher slopes which are now in forest reserves and are being reforested. The lower slopes have been largely denuded by cattle.

On account of the nature and arrangement of Oahu's mountain ranges there are fewer running streams than on the other large islands. The streams that exist are also smaller, as a rule. Except near Honolulu, most of the streams on the west side of the Koolau Mountains are intermittent in flow. For a short time after storms they carry water which is taken into ditches constructed for storm water, but they are practically dry for the greater part of the time. Kaukonahua Stream, at Wahiawa, is the largest on the west side of Koolau Range. All the streams on the east side of Koolau Range are short, but they have a good flow. Waianae is the principal stream from the Waianae Mountains. What Oahu lacks in surface supply is largely made up from underground sources. Cane, rice, and taro are extensively irrigated on this island. Pineapples require no irrigation.

Transportation facilities are better on Oahu than on any of the other islands. A belt road crosses the Koolau Range and the tableland between the mountain ranges, and a railroad extends almost completely around the island. It is thus easier to carry on field operations on this island than on the others.

Honolulu is the capital and principal town. In 1910 it had a population of 52,183 out of a total of 81,993 for the entire island. Watertown, Aiea, Waipahu, Ewa Mill, Waianae, Waialua, Kahuku, Kaneohe, and Waimanalo are important places.

The stations considered in this report are arranged in clockwise order, beginning at the southeast.

PALOLO STREAM BASIN.

GENERAL FEATURES.

Palolo basin lies on the south side of Koolau Mountains just back of Diamond Head. It is about 1 mile wide and 4 or 5 miles long. Palolo Stream, which drains this basin, is made up of Waiomao and Pukele branches. The Waiomao Branch is on the east and reaches up to the summit of the range just east of Kaau Crater, which drains into it. Water is diverted from the streams in this basin for taro irrigation.

WAIOMAO STREAM AT 950 FEET ELEVATION, NEAR HONOLULU, OAHU.

A gaging station was established on Waiomao Stream about 950 feet elevation October 10, 1911. A 3-foot weir and Watson clock register were installed. This station was put in for the purpose of determining the amount of water available at that point for a municipal supply for Kaimuki, which is a subdivision of Honolulu.

The discharge at this point includes the water which comes into the stream above from Kaau Crater.

Daily discharge, in second-feet, of Waiomao stream at 950 feet elevation, Palolo Valley, near Honolulu, Oahu, for 1911.

[David Andrews, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	0.8	1.5	11	0.8	0.7	4.3	21	0.6	0.8	1.2
2	.....	.7	1.2	12	.8	.6	2.7	22	.5	.8	2.9
3	.....	.8	.9	13	.8	.7	2.8	23	.5	.8	1.4
4	.....	.8	.7	14	.7	.7	2.0	24	1.2	1.2	1.2
5	.....	.8	.7	15	.7	.7	2.0	25	1.1	1.0	1.1
6	.....	.9	.7	16	.6	.7	1.0	26	1.4	1.1	.8
7	.....	.9	.8	17	.6	1.0	.8	27	1.5	1.2	3.2
8	.....	1.0	.8	18	.6	.8	2.6	28	1.3	1.0	.9
9	.....	.9	1.5	19	.6	1.1	1.4	29	1.3	1.0	1.2
10	0.8	.8	1.0	20	.6	.8	1.2	30	1.0	1.2	1.2
								31	.8	.....	.7

NOTE.—Daily discharge computed from head on 3-foot weir as recorded by Watson clock register.

Monthly discharge of Waiomao stream at 950 feet elevation, Palolo Valley, near Honolulu, Oahu, for Oct. 10 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 10–31	1.5	0.5	0.85	37.1
November	1.2	.6	.88	52.4
December	4.3	.7	1.50	92.2

WAIOMAO STREAM ABOVE PUKELE STREAM, NEAR HONOLULU, OAHU.

A gaging station was established on Waiomao stream at the bridge on the Government road about 1½ miles north of the car line, April 8, 1910. The station is a few hundred feet above the junction of Waiomao and Pukele streams.

A staff gage, graduated in tenths of feet and fastened to the left abutment of the bridge, is used to obtain gage heights.

Discharge measurements of Waiomao stream above Pukele stream, near Honolulu, Oahu, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 8	W. F. Martin	4.0	2.43	0.67	0.69
May 11	do	4.1	2.74	.70	.75
Do	do	4.6	2.65	.70	.79
July 14	Martin and Hardy	4.0	3.18	.72	1.41
Aug. 9	H. R. Schulz	4.1	3.34	.81	2.50
16	do	3.9	3.58	.70	1.48
19	do	6.2	4.41	.88	3.58
Sept. 5	do	2.1	1.14	.60	.52
12	do	4.0	2.85	.78	1.76
Nov. 11	do	3.9	3.79	.80	.60
Dec. 29	do	4.5	5.1	.90	1.29

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Waiomao Stream above Pukele Stream, near Honolulu, Oahu, for 1911.

[David Andrews, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.7	0.9	0.7	0.7	0.85	0.9	0.8	1.1
2	.....	.75	1.1	.7	.65	.85	.9	.8	1.0
3	.....	.90	.95	.7	.65	.85	1.1	.75	1.1
4	.....	.85	.95	.7	.65	.8	.9	.8	1.05
5	.....	.7	.90	1.05	.7	.65	.95	.8	.95
6	.....	.85	.8	.8	.65	.6	.9	.8	.9
7	.....	.7	.8	.75	.65	.7	.85	.85	1.0
8	.....	.75	.8	.75	.65	.8	.95	.95	.95
9	.....	.7	.85	.7	.8	.8	.80	.85	.95
10	.....	.7	.85	.75	.75	.85	.85	.85	.95
11	.....	.7	.80	.8	.7	1.05	.8	.8	1.2
12	0.7	.7	.80	.9	.9	.95	.9	.72	1.35
13	.8	.7	.8	.8	.85	.9	.85	.85	1.4
14	.7	.95	.8	.7	.8	.85	.9	.9	1.1
15	.7	.75	.7	.7	.85	.85	.85	.85	1.15
16	.9	.8	.7	.7	.7	.8	.85	.8	1.05
17	.8	.7	.7	.65	1.15	.85	.85	.8	1.2
18	.7	.75	.7	.65	1.05	.9	.8	.85	1.3
19	1.6	.75	.7	.65	.9	.85	.8	.85	1.3
20	1.0	.75	.7	.60	.85	.85	.85	.8	1.2
21	.9	.7	.7	.7	.85	.85	.85	.8	1.4
22	.9	1.0	.7	.65	.9	1.8	.8	.85	1.35
23	1.15	.8	.8	.65	.8	1.75	.8	.9	1.4
24	1.05	.7	.8	.7	.8	1.55	.8	.85	1.1
25	.9	.7	.8	.7	.85	1.45	.85	.9	1.0
26	.85	.75	.75	.75	.9	1.6	.8	.85	.9
27	.8	2.05	.7	.7	.85	1.1	.9	1.3	1.0
28	.75	.95	.7	.7	.7	1.0	.95	1.2	.95
29	.7	1.0	.7	.65	.85	1.0	.85	1.2	1.1
30	.7	.95	.7	.7	.85	1.0	.8	1.15	.....
31	.....	1.0	.....	.7	.85	.....	.85	.....	.....

Daily discharge, in second-feet, of Waiomao Stream above Pukele Stream, near Honolulu, Oahu, for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.8	4.0	1.2	1.2	3.2	1.3	0.6	4.0
2	.....	1.2	8.4	1.2	.8	3.2	1.3	.6	2.5
3	.....	2.9	5.0	1.2	.8	3.2	4.0	.4	4.0
4	.....	2.2	5.0	1.2	.8	2.4	1.3	.6	3.2
5	.....	.8	4.0	7.2	1.2	.8	1.9	.6	1.9
6	.....	2.2	2.4	2.4	.8	.5	1.3	.6	1.3
7	.....	.8	2.4	1.8	.8	1.2	1.0	1.0	2.5
8	.....	1.2	2.4	1.8	.8	2.4	1.9	1.9	1.9
9	.....	.8	3.2	1.2	2.4	2.4	.6	1.0	1.9
10	.....	.8	3.2	1.8	1.8	3.2	1.0	1.0	1.9
11	.....	.8	2.4	2.4	1.2	6.9	.6	.6	6.1
12	0.8	.8	2.4	4.0	4.0	4.5	1.3	.2	9.8
13	1.6	.8	2.4	2.4	3.2	3.3	1.0	1.0	11
14	.8	3.8	2.4	1.2	2.4	2.5	1.3	1.3	4.0
15	.8	1.2	1.2	1.2	3.2	2.3	1.0	1.0	5.0
16	2.9	1.6	1.2	1.2	1.2	1.5	1.0	.6	3.2
17	1.6	.8	1.2	.8	9.7	2.0	1.0	.6	6.1
18	.8	1.2	1.2	.8	7.2	2.2	.6	1.0	8.5
19	21	1.2	1.2	.8	4.0	1.6	.6	1.0	8.5
20	4.7	1.2	1.2	.5	3.2	1.4	1.0	.6	6.1
21	2.9	.8	1.2	1.2	3.2	1.2	1.0	.6	11
22	2.9	4.7	1.2	.8	4.0	23	.6	1.0	9.8
23	8.2	1.6	2.4	.8	2.4	22	.6	1.3	11
24	5.8	.8	2.4	1.2	2.4	16	.6	1.0	4.0
25	2.9	.8	2.4	1.2	3.2	12	1.0	1.3	2.5
26	2.2	1.2	1.8	1.8	4.0	17	.6	1.0	1.3
27	1.6	28	1.2	1.2	3.2	4.0	1.3	8.5	2.5
28	1.2	5.0	1.2	1.2	1.2	2.5	1.9	6.1	1.9
29	.8	6.0	1.2	.8	3.2	2.5	1.0	6.1	4.0
30	.8	5.0	1.2	1.2	3.2	2.5	.6	5.0	.....
31	.....	6.0	.....	1.2	3.2	.....	1.0	.....	.....

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 4 second-feet for the period May 27, to Sept. 10, and from parallel rating curves for the periods Apr. 12 to May 26, and Sept. 23 to Dec. 31. From Sept. 11 to 22 the indirect method for shifting channels was used. No records were obtained on Dec. 30 and 31.

Monthly discharge of Waiomao stream above Pukele stream, near Honolulu, Oahu, for Apr. 12 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 12–30	21	0.8	3.38	127	D.
May	28	.8	2.81	173	D.
June	8.4	1.2	2.43	145	D.
July	7.2	.8	1.58	97.1	C.
August	9.7	.8	2.71	167	C.
September	23	.5	5.11	304	D.
October	4.0	.6	1.14	70.1	D.
November	8.5	.2	1.60	95.2	D.
December 1–29	11	1.3	4.88	281	D.
The period	.....	.....	.....	1,460	

MISCELLANEOUS MEASUREMENTS IN PALOLO BASIN.

During 1910 and 1911 the following miscellaneous measurements were made in parts of Palolo basin. They are arranged in order downstream.

Miscellaneous measurements in Palolo Valley drainage basin in 1910–11.

Date.	Stream.	Tributary to—	Locality.	Discharge.
1910.				*Sec. ft.*
Oct. 5	Palolo	Manoa	Bridge on lower Palolo road	2.50
1911.				
Mar. 30	Waiomao	Palolo	Above foot of falls from Kaau Crater	.07
30	Kaau	Waiomao	Outlet from Kaau Crater	.36
30	do	do	do	.39
30	Waiomao	Palolo	100 feet below inflow from Kaau Crater	.41
Aug. 9	do	do	About 700 feet elevation	2.25
16	do	do	do	2.14
Sept. 5	do	do	About 800 feet elevation	1.03
12	do	do	do	2.00
12	do	do	About 950 feet elevation just below waterfall and springs on side.	1.50
12	do	do	Just above waterfalls and springs on side.	1.26
Nov. 11	do	do	About 800 feet elevation near weir	.72
Mar. 30	do	do	Bridge on Government road	1.07
Apr. 8	Pukele	do	Near Mahoe Springs	1.23
Aug. 9	Palolo	Manoa	Bridge on lower Palolo road	3.04
9	Waiomao ditch [a]	Waiomao	Intake above bridge on Government road.	1.60
16	do	do	do	1.11
19	do	do	do	1.57
Sept. 5	do	do	do	.46
Nov. 11	do	do	do	.12

[a] This ditch diverts water above the station at the bridge.

NOTE.—Palolo Stream is formed by Waiomao from the east and Pukele from the west.

MANOA STREAM BASIN.

GENERAL FEATURES.

Manoa is a deep broad basin on the south side of Koolau Mountains. It is west of Palolo basin and east of Tantalus Mountain. Manoa Stream is made up of several branches which enter the head of the valley over waterfalls. There are also a number of springs at the foot of the cliffs at the head of the valley.

The water in this basin is used for irrigating taro in the upper part of Manoa Valley.

MANOA STREAM AT UPPER END OF VALLEY, NEAR HONOLULU, OAHU.

A gaging station was established on Manoa Stream about half a mile below the junction of its three main branches, November 7, 1910. Two ditches on the east side divert water above the station.

A staff gage, graduated in tenths of feet, is fastened to the right bank and is used for obtaining gage heights. In July, 1911, the station was reestablished at a point a few hundred feet above the old station. A wooden bridge was built for making high-water measurements.

The discharge at this point gives the total flow of the stream exclusive of the two ditches on the east side, which take out above the station.

Discharge measurements of Manoa Stream at upper end of valley, near Honolulu, Oahu, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 6	C. H. Pierce	10.3	11.6	1.27	8.0
Nov. 7	W. F. Martin	10.1	11.7	1.29	8.1
17	do	10.5	15.9	1.64	15.8
1911.					
Mar. 31	W. F. Martin	9.8	9.4	0.85	3.91
July 19[a]	W. V. Hardy	12.0	16.2	[b] 2.90	4.99
Aug. 10	H. R. Schulz	15.0	19.7	[c] 3.09	11.3
25[d]	do	15.0	22.2	3.22	7.8
Sept. 7	do	12.6	13.6	2.73	4.62
Nov. 9	do	14.4	12.7	2.68	2.56
13	do	14.6	14.8	2.83	6.6
Dec. 30	do	14.3	14.5	2.86	4.44

[a] New gage established July 19, 1911, by W. V. Hardy. This gage is about 500 feet above the old gage and at a different datum.
[b] Height of water on old gage was 0.90 foot.
[c] The accuracy of this gage reading is doubtful. Height of water on old gage was 1.10 feet (accuracy doubtful).
[d] Conditions influenced by a temporary dam about 150 feet below gage.

Daily gage height, in feet, of Manoa Stream at upper end of valley, near Honolulu, Oahu, for 1910–11.

[Isigawa, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	1.35	11	1.4	1.2	21	1.1	1.05
2	.....	1.45	12	1.3	1.2	22	1.1	1.2
3	.....	1.3	13	1.45	1.2	23	1.15	1.15
4	.....	1.3	14	1.2	1.15	24	1.1	2.35
5	.....	1.65	15	1.5	1.15	25	1.1	1.65
6	.....	2.4	16	1.15	1.1	26	1.95	2.1
7	1.3	1.5	17	1.4	1.1	27	2.75	2.4
8	1.3	1.35	18	1.3	1.1	28	1.5	1.35
9	1.25	1.3	19	1.55	1.1	29	1.7	1.4
10	1.75	1.3	20	1.2	1.1	30	1.45	2.15
						31	.....	1.65

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.35	1.4	1.1	0.8	0.9	1.35	1.1	0.8	2.7	3.05	2.6	2.6
2	1.2	1.4	1.5	.8	1.25	1.8	.9	.85	2.7	2.9	2.6	2.6
3	1.15	1.7	1.25	.85	1.25	1.65	.9	.85	2.7	2.95	2.6	2.7
4	1.1	1.55	1.0	.8	.9	1.4	.85	1.0	2.75	2.9	2.6	2.6
5	1.3	1.6	.95	.8	.85	1.2	1.05	1.0	2.70	2.8	2.6	2.7
6	1.25	4.9	.9	.8	1.1	1.2	1.2	.85	2.70	2.9	2.6	2.6
7	1.15	1.6	.9	.8	1.1	1.4	1.6	.85	2.70	2.8	2.6	2.75
8	1.3	1.45	1.15	.8	.95	1.25	1.0	1.0	2.6	2.8	2.7	2.65
9	1.15	1.4	1.2	.8	.95	1.2	.9	1.35	2.6	2.75	2.8	2.6
10	1.4	1.9	1.3	.75	1.0	1.15	1.1	1.25	2.65	2.7	2.8	2.6
11	1.4	1.45	.95	.85	.9	1.1	1.6	2.95	3.2	2.7	2.9	2.95
12	1.9	1.3	.9	.85	.9	1.15	1.15	3.2	2.85	2.7	3.3	2.65
13	1.4	1.2	.9	.9	1.0	1.4	1.1	3.2	2.7	2.7	2.85	2.65
14	1.35	1.15	.9	.85	1.05	1.6	1.0	3.05	2.7	2.7	2.8	2.6
15	1.25	1.3	.9	.8	1.05	1.1	.95	2.95	2.7	2.7	2.8	2.6
16	1.15	1.1	.95	1.0	1.0	1.25	1.1	2.95	2.6	2.7	2.9	2.7
17	1.5	1.1	.9	.85	.9	1.0	1.0	3.5	3.15	2.6	2.7	2.8
18	1.3	1.0	.85	1.1	.9	.9	.9	3.1	3.0	2.6	2.7	2.9
19	1.2	1.0	.9	2.1	1.1	.9	.9	3.85	2.75	2.6	2.6	2.8
20	1.15	.9	.85	1.4	1.35	.95	.9	3.1	3.25	2.6	2.6	2.75

Daily gage height, in feet, of Manoa Stream at upper end of valley, near Honolulu, Oahu, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
21	1.15	0.9	0.8	1.35	2.1	1.3	1.0	2.9	3.95	2.6	2.6	3.3
22	1.15	.85	1.35	1.1	1.4	.95	.9	2.9	4.15	2.55	2.6	3.15
23	1.5	.75	1.2	1.7	1.1	.95	1.05	2.8	3.95	2.4	2.6	2.8
24	2.45	1.45	.95	1.4	1.0	.90	.9	2.8	4.15	2.5	2.75	2.8
25	1.85	1.1	1.05	1.2	.95	1.2	.9	2.8	3.25	2.55	2.65	2.8
26	1.55	1.45	1.3	1.1	.9	1.0	.85	2.9	3.25	2.8	2.7	2.8
27	2.1	1.4	.9	1.1	2.3	1.25	.85	2.75	3.15	2.6	2.65	2.85
28	2.4	1.25	.9	1.35	1.8	.9	.8	2.7	3.0	2.6	2.6	2.9
29	1.6	.....	.85	1.0	1.45	1.25	.8	2.95	2.9	2.75	2.6	2.9
30	1.5	.....	.85	.9	1.4	1.1	.8	2.95	3.65	2.9	2.6	2.8
31	1.45	.....	.85	.....	1.4	.....	.8	2.75	.....	2.9	2.6	2.75

Daily discharge, in second-feet, of Manoa Stream at upper end of valley, near Honolulu, Oahu, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	10	11	11	7.5	21	5.9	5.2
2	.....	12	12	9.2	7.5	22	5.9	7.5
3	.....	9.2	13	12	7.5	23	6.7	6.7
4	.....	9.2	14	7.5	6.7	24	5.9	39
5	.....	16	15	13	6.7	25	5.9	16
6	.....	41	16	6.7	5.9	26	26	30
7	9.2	13	17	11	5.9	27	55	41
8	9.2	10	18	9.2	5.9	28	13	10
9	8.4	9.2	19	14	5.9	29	18	11
10	20	9.2	20	7.5	5.9	30	12	32
						31	.....	16

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	10	11	5.9	2.3	3.3	10	5.9	2.3	6.4	14	4.8	4.8
2	7.5	11	13	2.3	8.4	21	3.3	2.8	6.4	10	4.8	4.8
3	6.7	18	8.4	2.8	8.4	16	3.3	2.8	6.4	12	4.8	6.4
4	5.9	14	4.5	2.3	3.3	11	2.8	4.5	7.4	10	4.8	4.8
5	9.2	15	3.9	2.3	2.8	7.5	5.2	4.5	6.4	8.3	4.8	6.4
6	8.4	173	3.3	2.3	5.9	7.5	7.5	2.8	6.4	10	4.8	4.8
7	6.7	15	3.3	2.3	5.9	11	15	2.8	6.4	8.3	4.8	7.4
8	9.2	12	6.7	2.3	3.9	8.4	4.5	4.5	4.8	8.3	6.4	5.6
9	6.7	11	7.5	2.3	3.9	7.5	3.3	10	4.8	7.4	8.3	4.8
10	11	24	9.2	1.9	4.5	6.7	5.9	8.4	5.6	6.4	8.3	4.8
11	11	12	3.9	2.8	3.3	5.9	15	12	19	6.4	10	12
12	24	9.2	3.3	2.8	3.3	6.7	6.7	19	9.2	6.4	23	5.6
13	11	7.5	3.3	3.3	4.5	11	5.9	19	6.4	6.4	9.2	5.6
14	10	6.7	3.3	2.8	5.2	15	4.5	14	6.4	6.4	8.3	4.8
15	8.4	9.2	3.3	2.3	5.2	5.9	3.9	12	6.4	6.4	8.3	4.8
16	6.7	5.9	3.9	4.5	4.5	8.4	5.9	12	4.8	6.4	10	6.4
17	13	5.9	3.3	2.8	3.3	4.5	4.5	31	18	4.8	6.4	8.3
18	9.2	4.5	2.8	5.9	3.3	3.3	3.3	16	13	4.8	6.4	10
19	7.5	4.5	3.3	30	5.9	3.3	3.3	48	7.4	4.8	4.8	8.3
20	6.7	3.3	2.8	11	10	3.9	3.3	16	21	4.8	4.8	7.4
21	6.7	3.3	2.3	10	30	9.2	4.5	10	52	4.8	4.8	23
22	6.7	2.8	10	5.9	11	3.9	3.3	10	63	4.2	4.8	18
23	13	1.9	7.5	18	5.9	3.9	5.2	8.3	52	2.5	4.8	8.3
24	43	12	3.9	11	4.5	3.3	3.3	8.3	63	3.5	7.4	8.3
25	22	5.9	5.2	7.5	3.9	7.5	3.3	8.3	21	4.2	5.6	8.3
26	14	12	9.2	5.9	3.3	4.5	2.8	10	21	8.3	6.4	8.3
27	30	11	3.3	5.9	37	8.4	2.8	7.4	18	4.8	5.6	9.2
28	41	8.4	3.3	10	9.2	3.3	2.3	6.4	13	4.8	4.8	10
29	15	.....	2.8	4.5	12	8.4	2.3	12	10	7.4	4.8	10
30	13	.....	2.8	3.3	11	5.9	2.3	12	38	10	4.8	8.3
31	12	.....	2.8	.....	11	.....	2.3	7.4	.....	10	.....	7.4

NOTE.—Daily discharge Oct. 6, 1910, to Aug. 10, 1911, computed from a rating curve for the old station, which is fairly well defined below 20 second-feet. After Aug. 10, 1911, daily discharge computed from a curve that is poorly defined.

Monthly discharge of Manoa Stream at upper end of valley, near Honolulu, Oahu, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 7–30	55	5.9	12.6	600	C.
December	41	5.2	13.5	830	C.
1911.					
January	43	5.9	13.1	805	C.
February	173	1.9	15.4	855	C.
March	13	2.3	4.90	301	C.
April	30	1.9	5.78	344	C.
May	37	2.8	7.66	471	C.
June	21	3.3	7.76	462	C.
July	15	2.3	4.85	298	C.
August	48	2.3	11.1	682	D.
September	63	4.8	17.5	1,040	D.
October	14	2.5	6.99	430	D.
November	23	4.8	6.72	400	D.
December	23	4.8	7.96	489	D.
The year	173	1.9	9.08	6,580	

NOTE.—These estimates do not include the amount of water diverted by two ditches farther up the valley.

MANOA STREAM AT COLLEGE OF HAWAII, NEAR HONOLULU, OAHU.

In 1909 the College of Hawaii built a 10-foot weir in Manoa Stream about half a mile above the crossing of Waialae Road and installed a Watson clock register for recording gage heights.

This weir was destroyed by high water in November, and an 8-foot weir was established at the same place in December of the same year.

In February, 1910, the weir was again destroyed by high water and was not rebuilt.

Beginning with April 13, 1910, a current-meter rating of the old weir bed was made by the Geological Survey and fragmentary records obtained by means of the Watson clock register until November 24, 1910.

Daily discharge has been computed by the Geological Survey from the clock record sheets furnished by the College of Hawaii.

This station was located on the college property just below the point at which it is proposed to build a dam for use in connection with the college hydraulic laboratory. There are numerous small diversions from the stream above for taro irrigation, but most of the water escapes back into the stream above the station.

The records at this point show the total flow of the stream exclusive of a small ditch with a capacity of about 2 second-feet, which heads a few hundred feet above the station.

Discharge measurements of Manoa Stream at College of Hawaii, near Honolulu, Oahu, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 13	W. F. Martin	6.8	3.63	0.16	3.06
18	.....do	7.2	4.41	0.24	4.04
June 18	Martin and Schnack	17.0	29.4	1.19	33.1

Daily discharge, in second-feet, of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for 1909–10.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909												
1				26	8.3	2.4	6.9	8.2	1.8	2.5	7.5	
2				30	7.9	1.2	4.6	37	2.7	6.8	7.0	
3					12	.5	4.5	8.8	1.8	7.5		
4					20	3.3	4.1	15	1.2	2.6		
5					11	6.9	5.6	9.4	1.3	4.4		
6					6.3	12	10	6.6	1.2	4.5		
7					9.0	3.0	10	6.9	1.1	2.4	1.9	
8					8.4	2.5	45	5.7	1.1	2.2	1.7	
9					11	2.4	34	4.6	1.3	2.0	1.7	
10					22	2.1	17	4.4	1.5	1.7	5.9	
11					12	2.1	13	3.9	1.2	.8	2.8	
12					10	2.6		2.5	.6	19	1.6	
13					8.9	2.0		3.9	1.1	10	6.4	
14					9.2	3.6		6.4	1.2	4.8	2.2	
15					4.4	3.1		5.7	1.8	3.1	1.5	
16					4.2	4.8	52	4.9	1.8	2.9	1.5	
17					18	4.5	35	4.3	1.5	1.9		
18					[a] 16	4.5	21	4.0	1.4	2.0		
19					15	6.8	27	2.5	1.6	2.6		
20					[b] 22	6.2	20	3.6	2.4	3.4		
21					9.7	27	22	5.8	1.4	9.0		
22					6.8	15	16	3.8	3.0	3.7		
23			9.1		6.8	12	9.4	3.9	12	7.5		
24			7.6		4.7	8.3	15	2.6	6.7	2.5		
25			11.		3.0	22	31	2.4	2.9	6.0		
26			17.		2.4	15	42	1.6	3.4	6.5		
27			27.		4.0	11	16	1.6	4.8	4.4		11
28			19.		5.3	7.3	11	1.7	5.4	14		10
29			26.		7.7	6.7	11	1.3	4.9	16		29
30			30.		4.5	16	12	1.4	3.0	2.4		11
31			27.		3.2		8.2	3.4		14		5.3
1910.												
1	4.0	3.1			8.7	34		2.2	4.8	27	2.4	
2	2.9	2.9			9.2	47		2.6	4.1	17	2.5	
3	2.6	1.9			7.4	26			12	14	30	
4		2.0			5.9	16	13		6.1	11	14	
5		2.0			11	13	10		4.1	12	10	
6		7.2			34	12	9.4		6.4	14	12	
7		1.6			42	15	7.0		7.2	13		
8		.00			19	29	5.6	5.6	3.4	16		
9		.00			18	26	4.1	17	11	16		
10	5.5	2.8			14	12	3.0	10	53	14		
11	6.0	44			9.4	9.2	3.0	14	15	10		
12	2.4				4.9	8.3		7.6	11	6.6	5.9	
13	2.2			2.5	2.6	17		8.7	9.2	11	4.9	
14	.30			1.8	2.6	21		15	7.9	8.5	3.9	
15	.21			2.0	4.5	22		7.4	4.9	5.4	3.3	
16	11			2.0	9.4	16		3.4	3.8		3.1	
17	13			38	2.6	17		2.5	3.1		7.6	
18	7.8			6.7	20	25	3.2	1.8	27		6.6	
19	4.4			5.4	30	16	3.2	1.8	40		4.2	
20	2.9			7.0	8.9	11	3.2	16	39		3.5	

[a] Interpolated.

[b] Watson clock register installed.

Daily discharge, in second-feet, of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for 1909–10—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
21	1.7			56	5.1		3.2	50	19		3.2	
22	2.8				3.4		2.8	16	12	2.2	3.9	
23	3.3				2.1			9.4	11	2.5	4.5	
24	2.9				1.8			8.3	15	2.6	3.5	
25	.6			58	2.2		1.9	48	25	2.2		
26	.03			40	2.1		3.5	16	34	2.2		
27	31			29	1.8		3.9	18	23			
28	47			20	1.8		22	12	19			
29	11			13	1.8		4.2	7.9	17			
30	13			11	48		2.5	6.6	21	3.9		
31	6.0				58		2.0	5.9		2.8		

NOTE.—From March to November, 1909, daily discharge obtained by means of a 10-foot weir, and from December, 1909, to February, 1910, by means of an 8-foot weir. Daily discharge from Apr. 13 to Nov. 24, 1910, computed from a current-meter rating curve that is fairly well defined below 35 second-feet. At high stages the range of the clock sheet was not sufficient to give a complete record, and for those periods the actual discharge was probably somewhat greater than the figures given. No records were obtained on the days for which discharge is not given.

Monthly discharge of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for 1909–10.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
May	22	2.4	9.47	582
June	27	.5	7.23	430
July 1–11 and 16–31	52	4.1	18.6	996
August	37	1.3	5.74	353
September	12	.6	2.57	153
October	24	.8	6.28	386
November 1–2 and 7–16	7.5	1.5	3.48	82.8
December 27–31	29	5.3	13.3	132
1910.				
January 1–3 and 10–31	47	.03	7.38	366
February 1–11	44	.00	6.14	134
April 13–21 and 25–30	58	1.8	19.3	574
May	58	1.8	12.7	781
June 1–20	47	8.3	19.6	778
July 4–11, 18–22 and 25–31	22	2.0	5.54	220
August 1–2 and 8–31	50	1.8	12.1	624
September	53	3.1	15.6	928
October 1–15, 22–26 and 30–31	27	2.2	9.7	423
November 1–6 and 12–24				

MANOA STREAM AT WAIALAE ROAD, NEAR HONOLULU, OAHU.

A gaging station was established on the lower stream at the bridge on Waialae road, November 6, 1910.

A staff gage, graduated into tenths of feet, was fastened to the rock wall on the right side of the stream just below the bridge. This station was destroyed by flood in February, 1911.

The discharge at this point does not give the total flow of the stream as several ditches take out water above.

Discharge measurements of Manoa Stream at Waialae road, near Honolulu, Oahu, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 6	C. H. Pierce	18.7	19.5	1.47	16.6
Nov. 5	W. F. Martin	10.2	6.6	1.30	9.2

NOTE.—Measurements made by wading at different sections.

Daily gage height, in feet, of Manoa Stream at Waialae road, near Honolulu, Oahu, for 1910–11.

[John Hobbs, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	1.2	11	2.0	1.15	21	1.1	1.1
2	.....	1.7	12	1.3	1.1	22	1.15	2.2
3	.....	1.1	13	1.1	1.15	23	1.2	2.3
4	.....	1.1	14	1.6	1.3	24	1.6	2.4
5	1.2	2.2	15	1.7	1.2	25	1.8	1.3
6	1.1	2.8	16	1.9	1.2	26	1.2	1.25
7	1.35	1.65	17	1.15	1.15	27	5.25	2.3
8	1.2	1.1	18	1.25	1.25	28	4.25	2.2
9	1.25	1.3	19	1.25	1.2	29	3.25	1.1
10	1.35	1.25	20	1.1	1.1	30	1.7	1.45
						31	.....	2.05

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1911.			1911.			1911.		
1	.....	1.55	11	1.55	.....	21	1.3	.....
2	.....	1.35	12	1.80	.....	22	1.55	.....
3	.....	1.8	13	2.2	.....	23	1.35	.....
4	.....	2.15	14	1.65	.....	24	2.8	.....
5	.....	2.05	15	1.5	.....	25	2.3	.....
6	.....	7.0	16	1.6	.....	26	1.70	.....
7	.....	.....	17	3.5	.....	27	2.3	.....
8	.....	.....	18	1.85	.....	28	3.05	.....
9	1.35	.....	19	1.65	.....	29	1.8	.....
10	1.30	.....	20	1.5	.....	30	1.5	.....
						31	1.7	.....

Daily discharge, in second-feet, of Manoa Stream at Waialae road, near Honolulu, Oahu, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	6.0	11	60	4.5	21	3.0	3.0
2	.....	31	12	9.0	3.0	22	4.5	84
3	.....	3.0	13	3.0	4.5	23	6.0	96
4	.....	3.0	14	24	9.0	24	24	109
5	6.0	84	15	31	6.0	25	39	9
6	3.0	167	16	49	6.0	26	6.0	7.5
7	11	28	17	4.5	4.5	27	630	96
8	6.0	3.0	18	7.5	7.5	28	430	84
9	7.5	9.0	19	7.5	6.0	29	243	3.0
10	11	7.5	20	3.0	3.0	30	31	16
						31	.....	66

Daily discharge, in second feet, of Manoa Stream at Waialae road, near Honolulu, Oahu, for 1910–11—Continued.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1911.			1911.			1911.		
1		21	11	21		21	9	
2		11	12	39		22	21	
3		39	13	84		23	11	
4		78	14	28		24	167	
5		66	15	18		25	96	
6		980	16	24		26	31	
7			17	288		27	96	
8			18	44		28	208	
9	11		19	28		29	39	
10	9.0		20	18		30	18	
						31	31	

NOTE.—Daily discharge computed from a rating curve that is only approximate.

Monthly discharge of Manoa Stream at Waialae road, near Honolulu, Oahu, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 5–30	630	3.0	63.8	3,290	D.
December	167	3.0	31.3	1,920	D.
1911.					
January 9–31	288	9.0	58.2	2,260	D.
February 1–6	980	11	199	2,370	D.

NOTE.—Estimates are only approximate.

MISCELLANEOUS MEASUREMENTS IN MANOA BASIN.

A number of small ditches take the water from Manoa Stream at various points for irrigating taro. A part of the water usually returns to the stream farther down and is taken out again by the lower ditches. During 1910 and 1911 measurements were made on nearly all these ditches. These measurements are arranged in order downstream.

Miscellaneous measurements in Manoa Valley drainage basin in 1910–11.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
1910.				*Sec.-ft.*
Apr. 5	Manoa Stream	Pacific Ocean	College of Hawaii	4.77
Sept. 15	East Branch	Manoa Stream	About half a mile above the house of James Boyd.	1.04
Oct. 6	Boyd ditch	East Branch	About 1,000 feet below intake	2.94
Nov. 7	do	do	do	1.44
Oct. 6	Manoa ditch	Manoa Stream	do	2.06
Nov. 7	do	do	do	1.44
Apr. 13	No. 11 ditch	do	West side, opposite College of Hawaii weir.	2.19
1911.				
Aug. 10	East Branch	do	Above Boyd ditch intake	3.57
10	Middle Branch	do	Bridge in upper Manoa Valley	7.5
10	West Branch	do	1,000 feet above road in upper Manoa Valley.	.70
Mar. 31	Boyd ditch	East branch	About 1,000 feet below intake	2.60
July 19	do	do	do	1.74
Aug. 10	do	do	do	1.73

Miscellaneous measurements in Manoa Valley drainage basin in 1910–11—Continued.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Aug. 25	Boyd ditch	East branch	About 1,000 feet below intake	1.70
Sept. 7	do	do	do	1.58
Nov. 13	do	do	do	4.46
Mar. 31	Manoa ditch	Manoa Stream	do	1.21
July 19	do	do	do	1.58
Aug. 10	do	do	do	1.21
25	do	do	do	1.08
Sept. 7	do	do	do	1.04
Nov. 13	do	do	do	2.25
Aug. 10	No. 1 ditch	do	Intake on west side of stream opposite Rowell's place.	5.9
25	do	do	do	2.71
11	No. 2 ditch	do	Intake on east side 200 feet below No. 1.	*a* .5
28	do	do	do	.00
11	No. 3 ditch	do	Intake on east side about 1,500 feet below No. 1.	2.69
28	do	do	do	1.64
11	No. 4 ditch	do	Intake on west side 1,800 feet below No. 1.	2.60
28	do	do	do	2.43
11	No. 5 ditch	do	Intake on east side near the concrete dam and wooden flume.	2.35
28	do	do	do	1.37
11	No. 6 ditch	do	Below intake on west side about 800 feet below No. 5.	4.28
28	do	do	do	2.68
11	No. 7 ditch	do	Below intake on west side 1,500 feet below No. 5.	*a* 1.00
28	do	do	do	1.17
11	No. 8 ditch	do	Below intake on west side 1,900 feet below No. 5.	*a* .75
28	do	do	do	.00
11	No. 9 ditch	do	Below intake on west side 3,000 feet below No. 5.	*a* 1.25
28	do	do	do	.72
11	No. 10 ditch	do	Intake on east side near College of Hawaii grounds.	5.9
28	do	do	do	5.5
11	No.11 ditch	do	Intake on west side on College of Hawaii grounds.	*a*.5
28	do	do	do	*a*.5
11	No. 12 ditch	do	Intake east side above Waialae car line.	*a*.5
28	do	do	do	.82
11	No. 13 ditch	do	Intake on east side below Waialae car line.	*a*.5

a Estimated.

NOTE.—Boyd and Manoa ditches take out on the east side above the regular station. The ditches below the station are numbered in order downstream.

PAUOA STREAM BASIN.

GENERAL FEATURES.

Pauoa is a small basin on the south side of Koolau Mountains just back of Honolulu, east of Pacific Heights. This basin has several springs which furnish the ordinary flow of the stream. The principal spring is called Kahuawai. It is 600 or 700 feet above sea level and flows 0.5 to 0.6 second-foot. The water in this basin is used for irrigating taro.

PAUOA STREAM NEAR HONOLULU, OAHU.

A gaging station was established on Pauoa stream about half a mile below Kahuawai Spring, April 5, 1911. This station is at a point just below where a part of the diversions from the stream and springs above has returned.

A staff gage, graduated into tenths of feet, is fastened to a big stone on the left bank and is used to obtain gage heights. In October, 1911, a 4-foot weir was installed for measuring the flow and a Watson clock register was established for measuring the height on the weir.

One small ditch diverts water for irrigation above this station, and residences on Pacific Heights are supplied from the upper springs by a pipe line.

Discharge measurements of Pauoa Stream below Kahuawai Springs, near Honolulu, Oahu, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 5	W. F. Martin	5.4	3.8	0.70	1.36
13	do	5.4	3.8	.65	1.16
May 11	do	5.3	2.8	.63	1.02
11	do	5.3	2.9	.65	1.09
June 7	do	5.4	5.7	.90	3.08
Aug. 13	H. R. Schulz	5.4	4.6	.75	1.75
Sept. 6	do	5.3	4.3	.63	0.99
Oct. 17[a]	W. F. Martin			[b].37	3.00
Nov. 10	H. R. Schulz	3.5	3.4	[c].22	1.94

[a] 4-foot weir installed.
[b] Head on 4-foot weir. Height of water on staff gage was 0.90.
[c] Head on 4-foot weir.

Daily gage height, in feet, of Pauoa Stream below Kahuawai Springs, near Honolulu, Oahu, for 1911.

[Miyawaki, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	0.66	0.83	0.92	0.70	0.66	0.84
2	.....	.66	.98	.86	.70	.64	.84
3	.....	.70	1.02	.87	.72	.63	.90
4	.....	.65	.88	.88	.72	.62	.80
5	.....	.64	.80	.88	.77	.62	.74
6	.....	.71	.74	.96	.78	.62	.76
7	.....	.68	.86	.94	.70	.63	.78
8	.....	.68	.82	.89	.72	.66	.75
9	.....	.70	.75	.85	.73	.72	.84
10	.....	.66	.74	.84	.75	.66	.90
11	.....	.66	.72	.85	.74	.80	.88
12	.....	.64	.72	.84	.87	.73	.91
13	.....	.64	.90	.82	.95	.66	.91
14	0.64	.66	1.02	.80	.75	.64	.90
15	.64	.65	.83	.80	.72	.64	.90
16	.64	.64	.86	.78	.70	.64	.90
17	.67	.64	.82	.78	.86	.82	.....
18	.65	.63	.81	.78	.81	.89	.....
19	.96	.62	.78	.78	1.08	.85	.....
20	.78	1.12	.78	.78	1.05	1.05	.....
21	.90	1.25	.92	.78	.78	1.25	.....
22	.76	1.52	.86	.79	.71	2.68	.....
23	1.10	.71	.84	.80	.70	2.10	.....
24	.95	.64	.84	.80	.68	4.40	.....
25	.80	.64	.88	.78	.67	.98	.....
26	.70	.65	.91	.78	.78	.98	.....
27	.65	1.16	.90	.76	.72	.95	.....
28	.64	.94	.84	.74	.66	.89	.....
29	.64	.84	.94	.73	.68	.86	.....
30	.66	.72	.97	.72	.68	.90	.....
31	.....	.78	.....	.70	.68	.....	.....

Daily discharge, in second-feet, of Pauoa Stream below Kahuawai Springs, near Honolulu, Oahu, for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.2	2.4	3.2	1.4	1.2	2.5	2.0	1.8
2	.....	1.2	3.9	2.6	1.4	1.1	2.5	1.9	1.4
3	.....	1.4	4.3	2.7	1.5	1.0	3.0	1.9	1.3
4	.....	1.2	2.8	2.8	1.5	1.0	2.1	1.9	1.3
5	.....	1.1	2.1	2.8	1.9	1.0	1.7	1.8	1.3
6	.....	1.5	1.7	3.7	2.0	1.0	1.8	1.8	1.4
7	.....	1.3	2.6	3.4	1.4	1.0	2.0	1.7	3.4
8	.....	1.3	2.3	2.9	1.5	1.2	1.8	1.7	4.7
9	.....	1.4	1.8	2.6	1.6	1.5	2.5	1.7	3.8
10	.....	1.2	1.7	2.5	1.8	1.2	3.0	3.2	3.2
11	.....	1.2	1.5	2.6	1.7	2.1	2.8	2.0	6.4
12	.....	1.1	1.5	2.5	2.7	1.6	3.1	1.4	5.6
13	.....	1.1	3.0	2.3	3.6	1.2	3.1	2.3	2.8
14	1.1	1.2	4.3	2.1	1.8	1.1	3.0	2.9	8.2
15	1.1	1.2	2.4	2.1	1.5	1.1	3.0	5.5	5.6
16	1.1	1.1	2.6	2.0	1.4	1.1	3.0	2.0	2.7
17	1.2	1.1	2.3	2.0	2.6	2.3	3.0	2.2	2.3
18	1.2	1.0	2.2	2.0	2.2	2.9	3.0	2.4	3.3
19	3.7	1.0	2.0	2.0	5.0	2.6	2.8	1.8	2.4
20	2.0	5.4	2.0	2.0	4.6	4.6	2.8	2.0	2.0
21	3.0	6.9	3.2	2.0	2.0	6.9	2.0	2.0	3.9
22	1.8	10	2.6	2.0	1.5	24	2.7	1.9	2.2
23	5.2	1.5	2.5	2.1	1.4	17	2.6	2.8	2.2
24	3.6	1.1	2.5	2.1	1.3	45	2.7	2.0	2.3
25	2.1	1.1	2.8	2.0	1.2	3.9	2.7	1.9	2.6
26	1.4	1.2	3.1	2.0	2.0	3.9	2.6	1.6	3.2
27	1.2	5.9	3.0	1.8	1.5	3.6	2.6	1.7	2.2
28	1.1	3.4	2.5	1.7	1.2	2.9	2.6	1.7	2.3
29	1.1	2.5	3.4	1.6	1.3	2.6	2.2	1.6	3.8
30	1.2	1.5	3.8	1.5	1.3	3.0	2.0	1.5	6.4
31	.....	2.0	.....	1.4	1.3	.....	2.0	.....	2.8

NOTE.—Daily discharge Apr. 14 to Oct. 16 computed from a rating curve that is well defined below 3.5 second-feet. From Oct. 17 to Dec. 31 daily discharge computed from head on 4-foot weir as recorded by Watson clock register.

Monthly discharge of Pauoa Stream below Kahuawai Springs, near Honolulu, Oahu, for Apr. 14 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 14–30	5.2	1.1	1.93	65.1	A.
May	10	1.0	2.11	130	A.
June	4.3	1.5	2.63	156	A.
July	3.7	1.4	2.29	141	A.
August	5.0	1.2	1.91	117	A.
September	45	1.0	4.82	287	A.
October	3.1	1.7	2.55	157	A.
November	5.5	1.4	2.09	124	A.
December	8.2	1.3	3.19	196	A.
The period	.....	.....	.....	1,370	

MISCELLANEOUS MEASUREMENTS IN PAUOA BASIN.

The following miscellaneous measurements on the streams, springs, and ditches in Pauoa basin were made during 1910–11. They are arranged in order downstream.

Miscellaneous measurements in Pauoa Valley drainage basin in 1910–11.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
1910. Apr. 13	Kaaikahi Spring	Pauoa Stream	Below inflow from springs about 300 feet below road.	0.58
1911. Apr. 6	Pauoa Stream	Nuuanu Stream	50 feet below concrete intake for Pacific Heights.	.47
6	Ditch	Pauoa Stream	East side below intake to Pacific Heights.	.33
6	Pauoa Stream	Nuuanu Stream	Opposite Kahuawai Spring	.81
6	Ditch	Pauoa Stream	East of Kahuawai Spring intake below Pacific Heights intake.	.33
6	Pauoa Stream	Nuuanu Stream	400 feet below Kahuawai Spring	1.34
6	do	do	50 feet above road crossing and intake of ditch.	1.63
6	do	do	Just below inflow from Kaaikahi Spring.	.54
Aug. 13	do	do	do	.27
Apr. 13	Pauoa ditch	Pauoa Stream	Intake on west side at road crossing	1.58
Aug. 13	do	do	do	2.07
Sept. 6	do	do	do	.83

NUUANU STREAM BASIN.

GENERAL FEATURES.

Nuuanu Stream drains one of the principal basins on the southern slope of the Koolau Range. The basin lies back of Honolulu and extends to the summit of the range, which it has cut through, forming a pass. This valley is 1 to 2 miles wide and about 6 miles long. The famous Pali Road, from Honolulu over to the Koolau side of the island, extends up this valley. The rainfall is very heavy in this basin, averaging about 140 inches at Lower Luakaha. Nuuanu Stream rises at the head of the valley and receives several tributaries from both sides. The water of this stream is impounded in four reservoirs at different elevations and used for city supply. Below the reservoirs there are several small ditches which supply water for irrigating taro land.

NUUANU STREAM AT KUAKINI STREET, HONOLULU, OAHU.

A gaging station was established on this stream at Kuakini Street in Honolulu November 16, 1911.

A staff gage, graduated in tenths of feet, is fastened to the west abutment of the bridge and is used to obtain gage heights.

Low-water measurements are made by wading; high-water measurements are made from the lower side of the bridge. The discharge at this station shows the quantity of water passing down to sea below all diversions.

Discharge measurements of Nuuanu Stream at Kuakini Street, Honolulu, Oahu, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 16	H. R. Schulz	12.0	9.0	0.54	4.54
18	do	11.9	9.6	.56	5.1
Dec. 6	do	11.5	8.0	.44	3.40
8	do	29.0	24.4	.82	15.7
16	do	19.0	21.6	.89	17.3

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Nuuanu Stream at Kuakini Street, Honolulu, Oahu, for 1911.

[Oshimo, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.45	11		0.79	21	0.58	0.90
2		.42	12		.80	22	.50	.78
3		.44	13		.78	23	.58	.62
4		.48	14		.61	24	.52	.55
5		.42	15	0.95	.66	25	.51	.54
6		.46	16	.55	.88	26	.44	.49
7		.59	17	.52	.71	27	.51	.52
8		.79	18	.58	.61	28	.61	.92
9		.76	19	.65	.62	29	.58	.62
10		.69	20	.51	.60	30	.51	.56
						31		.55

Daily discharge, in second-feet, of Nuuanu Stream at Kuakini Street, Honolulu, Oahu, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		3.1	11		14	21	5.9	19
2		2.9	12		14	22	3.9	13
3		3.0	13		13	23	5.9	7.2
4		3.5	14		6.8	24	4.3	5.0
5		2.9	15	21	8.6	25	4.1	4.8
6		3.3	16	5.0	18	26	3.0	3.7
7		6.2	17	4.3	10	27	4.1	4.3
8		14	18	5.9	6.8	28	6.8	20
9		13	19	8.2	7.2	29	5.9	7.2
10		9.8	20	4.1	6.5	30	4.1	5.3
						31		5.0

NOTE.—Daily discharge computed from a rating curve fairly well defined between 3 and 18 second-feet.

Monthly discharge of Nuuanu Stream at Kuakini Street, Honolulu, Oahu, for Nov. 15 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 15-30	21	3.0	6.03	191	B.
December	20	2.9	8.42	518	B.

LULUMAHO DITCH IN NUUANU VALLEY, NEAR HONOLULU, OAHU.

Lulumaho ditch diverts water from Lulumaho Stream into the upper city reservoir known as No. 4. This stream is tributary to Nuuanu Stream below the reservoir but the normal flow is collected in the reservoir through the ditch.

A staff gage, graduated in tenths of feet, was placed on this ditch a short distance above the reservoir September 2, 1911.

The discharge at this station shows the amount of water furnished to the reservoir from Lulumaho Stream.

Discharge measurements of Lulumaho ditch in Nuuanu Valley, near Honolulu, Oahu, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet*	*Feet.*	*Sec.-ft.*
Sept. 2	H. R. Schulz	4.0	1.44	0.47	1.02
Nov. 14	do	5.0	3.37	.79	4.77
20	do	4.0	1.47	.42	0.53

NOTE.—An additional measurement made early in 1912 was used in determining the rating.

Daily gage height, in feet, of Lulumaho ditch in Nuuanu Valley, near Honolulu, Oahu, for 1911.

[L. A. Moore, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Date.	Sept.	Oct.	Nov.	Dec
1	.....	0.58	0.45	0.40	16	0.42	0.49	0.50	0.55
2	0.46	.55	.45	.40	17	.65	.49	.50	.48
3	.45	.60	.44	.40	18	.55	.48	.45	.44
4	.60	.55	.44	.41	19	.50	.48	.42	.40
5	.50	.55	.45	.45	20	.53	.48	.42	.57
6	.45	.52	.43	.47	21	1.50	.48	.45	.72
7	.43	.50	.42	.50	22	1.55	.48	.42	.70
8	.45	.50	.41	.44	23	.80	.48	.40	.48
9	.45	.50	.40	.55	24	.80	.50	.70	.42
10	.49	.50	.65	.45	25	.79	.48	.45	.40
11	.60	.50	.41	.71	26	.65	.48	.42	.40
12	.45	.50	.40	.70	27	.57	.47	.60	.50
13	.45	.50	.60	.50	28	.55	.47	.50	.60
14	.43	.50	.55	.50	29	.55	.46	.45	.48
15	.43	.50	.52	.46	30	.60	.45	.42	.47
					31	.....	.45	.....	.46

Daily discharge, in second-feet, of Lulumaho ditch in Nuuanu Valley, near Honolulu, Oahu, for 1911.

Day.	Sept.	Oct.	Nov.	Dec.	Day	Sept.	Oct.	Nov.	Dec
1	.....	2.0	0.7	0.4	16	0.5	1.1	1.2	1.7
2	0.8	1.7	.7	.4	17	2.9	1.1	1.2	1.0
3	.7	2.3	.7	.4	18	1.7	1.0	.7	.7
4	2.3	1.7	.7	.4	19	1.2	1.0	.5	.4
5	1.2	1.7	.7	.7	20	1.5	1.0	.5	1.9
6	.7	1.4	.6	.9	21	16	1.0	.7	3.8
7	.6	1.2	.5	1.2	22	17	1.0	.5	3.6
8	.7	1.2	.4	.7	23	4.9	1.0	.4	1.0
9	.7	1.2	.4	1.7	24	4.9	1.2	3.6	.5
10	1.1	1.2	2.9	.7	25	4.7	1.0	.7	.4
11	2.3	1.2	.4	3.7	26	2.9	1.0	.5	.4
12	.7	1.2	.4	3.6	27	1.9	.9	2.3	1.2
13	.7	1.2	2.3	1.2	28	1.7	.9	1.2	2.3
14	.6	1.2	1.7	1.2	29	1.7	.8	.7	1.0
15	.6	1.2	1.4	.8	30	2.3	.7	.5	.9
					31	.....	.7	.....	.8

NOTE.—Daily discharge computed from a poorly defined rating curve.

Monthly discharge of Lulumaho ditch in Nuuanu Valley, near Honolulu, Oahu, for Sept. 2 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
September 2–30	17	0.5	2.74	158	C.
October	2.3	.7	1.19	73.2	C.
November	3.6	.4	0.99	58.9	C.
December	3.8	.4	1.28	78.7	C.

LUAKAHA WEIR IN NUUANU VALLEY, NEAR HONOLULU, OAHU.

Below the big reservoir in the upper part of Nuuanu Valley there are springs which are intercepted by Luakaha ditch several hundred feet lower down. The water in this ditch is measured by a small weir before it enters the pipes leading to the lower reservoirs. The records at this weir have been furnished by the Department of Public Works.

Discharge measurements of Luakaha weir in Nuuanu Valley, near Honolulu, Oahu, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Inches.*	*Sec.-ft.*
Sept. 23	W. F. Martin	4.3	2.86	8	7.45
23	C. H. Pierce	4.3	2.86	8	7.57
1911.					
Aug. 7	H. R. Schulz	5.9	3.61	.....	5.57
23	.....do	4.7	4.45	7.2	6.09

Daily discharge, in second-feet, of Luakaha weir in Nuuanu Valley, near Honolulu, Oahu, for 1910–11.

[L. A. Moore, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	7.3	2.1	2.6	3.1	3.1	10	7.3	4.2	2.1	8.0	5.4	7.3
2	4.8	2.1	3.6	3.1	2.6	7.3	6.0	4.2	2.1	7.3	4.8	7.3
3	7.3	2.1	2.6	3.1	2.6	10	10	4.8	2.1	7.3	5.4	6.6
4	7.3	2.6	4.8	2.6	2.6	7.3	7.3	21	2.1	7.3	10	7.3
5	7.3	3.1	2.6	2.6	3.1	6.0	6.0	6.0	2.1	7.3	6.6	7.3
6	7.3	3.6	3.1	3.1	21	5.4	6.0	5.4	2.1	7.3	6.0	7.3
7	7.3	2.1	3.1	3.1	10	5.4	6.0	5.4	2.1	7.3	7.3	6.6
8	1.7	4.8	2.6	3.6	3.1	10	6.0	5.4	2.1	8.0	7.3	6.6
9	1.7	4.8	2.6	3.1	3.1	7.3	6.0	5.4	2.1	7.3	6.0	6.6
10	3.1	4.8	2.6	3.1	3.1	6.0	5.4	5.4	2.1	7.3	10	10
11	2.6	7.3	4.2	2.6	2.6	6.0	5.4	7.3	2.1	7.3	6.6	8.0
12	3.1	6.6	2.1	2.6	2.6	5.4	5.1	7.3	2.1	10	6.6	10
13	2.1	4.8	2.1	2.1	2.6	7.3	4.8	4.8	2.1	7.3	6.0	8.0
14	2.1	3.1	2.1	2.1	2.6	10	4.8	6.0	2.1	7.3	6.0	7.3
15	2.1	2.6	2.1	2.1	2.6	7.3	4.8	4.8	2.1	6.6	6.6	6.6
16	2.1	2.6	2.1	2.1	2.6	6.0	4.8	4.8	2.1	7.3	6.6	6.6
17	2.1	2.6	2.1	3.6	2.6	5.4	4.8	4.2	2.1	6.6	7.3	10
18	2.1	2.6	2.1	2.6	21	10	4.8	4.2	21	6.0	6.0	7.3
19	2.1	2.6	10	2.6	10	7.3	4.8	4.2	2.1	5.4	6.0	6.6
20	1.7	2.1	3.6	4.2	3.6	6.0	6.0	5.4	21	5.4	6.0	6.6

Daily discharge, in second-feet, of Luakaha weir in Nuuanu Valley, near Honolulu, Oahu, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
21	1.7	2.1	3.1	4.2	3.1	21	6.0	10	2.1	5.4	5.4	6.6
22	1.7	2.1	3.1	3.1	3.1	6.0	4.8	6.0	2.1	5.4	5.4	6.0
23	2.1	2.6	3.1	2.6	2.6	10	4.8	4.8	2.1	4.8	5.4	6.0
24	2.1	2.6	3.1	6.0	2.6	7.3	4.8	4.8	21	4.8	5.4	21
25	1.7	2.6	2.6	6.0	2.6	7.3	4.8	21	2.1	4.8	5.4	21
26	2.1	2.6	2.6	3.6	2.6	6.6	5.4	10	2.1	4.8	7.3	10
27	2.6	2.6	2.6	3.6	2.6	6.0	5.4	10	2.1	4.8	21	21
28	2.1	3.1	2.6	3.6	2.6	7.3	6.0	8.0	2.1	6.0	10	21
29	2.1	.....	3.6	3.1	2.6	7.3	4.8	7.3	2.1	5.4	7.3	8.0
30	2.1	.....	6.0	3.1	2.6	7.3	4.2	6.0	2.1	5.4	6.6	10
31	1.7	.....	2.6	.....	21	.....	4.2	5.4	.....	5.4	.....	10
1911.												
1	6.6	10	12	10	12	13	11	4.8	6.6	10	6.0	4.8
2	7.3	8.0	12	10	12	21	11	4.8	6.0	10	6.0	4.8
3	6.0	21	11	10	11	17	12	6.6	6.0	10	6.0	4.8
4	6.0	13	11	8.7	11	13	13	6.0	6.6	8.7	6.0	5.4
5	8.0	21	11	8.7	11	12	13	6.6	6.0	8.7	6.0	4.8
6	21	21	10	8.7	13	12	13	6.0	5.4	8.7	6.0	7.3
7	7.3	17	13	8.0	13	13	12	6.0	5.4	10	6.0	7.3
8	6.6	13	21	8.0	12	13	10	8.0	5.4	10	6.0	7.3
9	6.6	13	21	8.0	10	12	10	7.3	5.4	8.7	6.0	7.3
10	6.0	21	21	8.7	9.5	12	13	10	5.4	8.0	10	7.3
11	6.0	12	13	8.0	8.7	11	10	8.7	7.3	7.3	7.3	10
12	6.0	12	13	13	8.7	11	10	10	6.6	7.3	6.0	7.3
13	5.4	12	12	8.0	8.0	13	8.7	6.6	6.0	7.3	10	6.6
14	5.4	12	12	7.3	8.0	17	8.7	6.6	6.0	7.3	10	6.0
15	5.4	12	12	7.3	7.3	13	8.0	7.3	5.4	7.3	8.7	6.0
16	5.4	12	13	8.7	7.3	13	8.0	10	5.4	7.3	10	8.7
17	5.4	12	13	8.0	7.3	12	7.3	8.0	7.3	7.3	7.3	7.3
18	4.8	12	10	10	6.6	11	7.3	7.3	6.0	6.0	6.0	7.3
19	4.8	12	11	21	6.6	11	7.3	13	6.0	6.0	6.0	6.6
20	4.8	12	11	13	13	11	6.0	7.3	7.3	6.0	5.4	6.0
21	4.8	10	21	21	21	17	6.0	7.3	21	6.0	7.3	10
22	10	10	17	13	21	13	6.6	6.6	10	6.0	5.4	10
23	7.3	9.5	13	17	13	17	6.0	6.6	21	6.0	6.0	7.3
24	7.3	21	13	17	13	13	5.4	6.0	21	10	21	6.0
25	6.6	13	12	13	12	13	5.4	6.0	10	7.3	10	6.0
26	7.3	21	13	13	11	12	4.8	6.0	10	6.6	7.3	5.4
27	21	21	11	13	10	12	4.8	6.0	8.7	6.6	6.0	7.3
28	7.3	21	11	12	12	11	4.8	6.0	8.7	6.6	6.0	10
29	7.3	.....	10	12	13	13	4.8	6.0	8.7	6.6	5.4	6.0
30	10	.....	10	12	13	13	4.8	10	10	6.6	13	6.0
31	10	.....	10	.....	13	.....	4.2	7.3	.....	6.0	.....	5.4

NOTE.—Daily discharge computed from head on 4-foot weir. Readings made daily at 5 p. m. The maximum measuring capacity of weir is 21 second-feet, but at times the weir was flooded and the discharge somewhat greater than this.

Monthly discharge of Luakaha weir in Nuuanu Valley, near Honolulu, Oahu, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
January	7.3	1.7	3.20	197	A.
February	7.3	2.1	3.19	177	A.
March	10	2.1	3.15	194	A.
April	6.0	2.1	3.20	190	A.
May	21	2.6	5.00	307	A.
June	21	5.4	7.72	459	A.
July	10	4.2	5.53	340	A.
August	21	4.2	6.89	424	A.
September	21	2.1	3.99	237	A.
October	10	4.8	6.47	398	A
November	21	4.8	7.06	420	A.
December	21	6.0	9.37	576	A.
The year	21	1.7	5.41	3,920	

Monthly discharge of Luakaha weir in Nuuanu Valley, near Honolulu, Oahu, for 1910–11—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1911.					
January	21	4.8	7.54	464	A.
February	21	8.0	14.4	800	A.
March	21	10	13.0	799	A.
April	21	7.3	11.2	666	A.
May	21	6.6	11.6	713	A.
June	21	11	13.2	786	A.
July	13	4.2	8.29	510	A.
August	13	4.8	7.25	446	A.
September	21	5.4	8.35	497	A.
October	10	6.0	7.62	469	A.
November	21	5.4	7.60	452	A.
December	10	4.8	6.85	421	A.
The year	21	4.2	9.70	7,020	

MISCELLANEOUS MEASUREMENTS IN NUUANU BASIN.

During 1911 a number of miscellaneous measurements were made in Nuuanu basin at various points. These measurements are arranged in order downstream.

Miscellaneous measurements in Nuuanu Valley drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Aug. 4	Nuuanu Stream	Big reservoir	Above reservoir No. 4	0.74
23	do	do	do	1.32
4	East Fork	do	do	3.64
23	do	do	do	.73
23	do	do	do	1.13
4	Nuuanu Stream	Springs and seepage	About 200 feet below reservoir No. 4 and opposite old weir.	[a] 2.03
7	do	do	do	[b] 2.27
23	do	do	do	[c] 2.51
Nov. 14	do	do	do	[d] 1.85
20	do	do	do	[e] 1.58
20	do	do	About 300 feet below dam of reservoir No. 4.	[f] 4.08
Aug. 7	West tributary	Nuuanu Stream	Culvert at spring watering trough	.36
7	do	do	West of car line opposite Laimi road	1.06
4	Lulumaho ditch	Reservoir No. 4	Above reservoir No. 4	0.80
5	No. 1 ditch	Nuuanu Stream	Below intake near rock crusher	3.03
7	do	do	do	1.28
7	do	do	West of car line opposite Laimi road	.72
23	do	do	Intake near rock crusher	2.33
5	No. 2 ditch	do	Below intake at new dam on west side near Laimi road.	.81
5	No. 3 ditch	do	Old bridge above Waldron's residence.	.91

[a] Depth in reservoir 39.0 feet.
[b] Depth in reservoir 39.5 feet.
[c] Depth in reservoir 41.0 feet.
[d] Main stream only, depth in reservoir 37.0 feet.
[e] Main stream only, depth in reservoir 36.0 feet.
[f] Depth in reservoir 36.0 feet.

NOTE.—Water passing reservoir No. 4 is picked up by Luakaha ditch and delivered to lower reservoirs. Ditches are numbered in order downstream, No. 1 taking out below all reservoir diversions.

KALIHI STREAM BASIN.

Kalihi basin lies next to Nuuanu basin on the northwest. It extends back toward the Koolau Range with a length of about 6 miles. The upper end is about 1 mile wide, but near the sea the width increases to 2 miles or more.

Kalihi Stream is largely used for irrigating taro lands in the central and lower part of the valley. In addition to the water coming down from the Koolau Mountains, considerable water also appears in the form of springs on the west side of the valley.

The following miscellaneous measurements were made in Kalihi Valley during 1911:

Miscellaneous measurements in Kalihi Valley drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Aug. 24	Kalihi Stream	Pacific Ocean	Above all diversions	4.5
24	No. 1 ditch	Kalihi Stream	Intake above small rice mill	3.83
24	No. 2 ditch	do	Just below intake	1.70
24	No. 3 ditch	do	Below intake	.68
24	No. 4 ditch	do	do	1.10
24	No. 5 ditch	do	do	*a* .50

a Estimated.

NOTE.—Ditches are numbered in order downstream.

KAUKONAHUA STREAM BASIN.

GENERAL FEATURES.

Upper Kaukonahua basin lies on the western slope of central Koolau Range. The basin reaches back to the summit of the range, where there is a comparatively low pass. This basin furnishes a larger quantity of water than any other basin on the western slope of Koolau Mountains. The rainfall in the upper part of it is heavy, because the pass admits the clouds without robbing them of all their moisture, most of which is precipitated on the west side.

Kaukonahua Stream is formed by two main branches, North and South forks, which unite on the tableland near Wahiawa. Just below the confluence of the two forks the Wahiawa Dam has been constructed, which backs the water up each stream for a considerable distance and forms one of the largest storage reservoirs on the island.

During 1911 the Engineer Corps of the United States Army established weirs on both forks of the stream for the purpose of determining the relative amounts of water supplied by each.

SOUTH FORK OF KAUKONAHUA STREAM NEAR WAHIAWA, OAHU.

The South Fork of Kaukonahua Stream is included in the United States military reservation. It is south of Waikakalaua Stream, which flows southward to Pearl Harbor. The records of this stream have been obtained by the Engineer Corps of the United States Army and furnished to the Geological Survey through the courtesy of Capt. A. B. Putnam.

Daily discharge, in second-feet, of South Fork of Kaukonahua Stream, near Wahiawa, Oahu, for 1911.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.8	68	67	3.8	4.1	16	.....	8.1	16	7.7	5.8	22
2	.....	8.6	15	26	2.8	3.2	17	.....	61	31	7.7	13	38
3	.....	9.0	11	20	2.6	3.1	18	.....	44	88	7.3	12	14
4	.....	5.8	11	32	2.6	2.8	19	12	26	32	7.3	11	9.8
5	.....	5.8	9.0	21	4.0	2.4	20	10	32	30	5.5	12	7.8
6	.....	5.8	12	20	4.0	6.2	21	14	15	38	5.0	11	1.7
7	.....	4.4	9.0	22	2.5	19	22	21	10	54	4.9	11	26
8	.....	7.3	9.0	21	2.2	25	23	10	10	70	4.7	21	7.1
9	.....	4.4	6.5	16	1.8	32	24	10	9.4	98	5.3	22	2.5
10	.....	11	9.0	14	2.5	7.8	25	12	8.1	67	5.0	21	1.4
11	.....	10	8.1	11	5.0	14	26	7.7	12	40	3.8	15	1.1
12	.....	15	41	10	2.2	21	27	7.3	31	49	5.5	9.2	0.9
13	.....	22	39	10	3.8	16	28	6.5	12	25	3.8	8.5	14
14	.....	16	15	9.4	17	10	29	6.1	8.6	35	2.8	6.3	16
15	.....	10	12	8.6	26	11	30	5.8	29	36	2.6	4.8	4.5
							31	5.8	a48	.....	2.6	.....	3.0

a Interpolated.

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in gallons per 24 hours.

Monthly discharge of South Fork of Kaukonahua Stream near Wahiawa, Oahu, for July 19 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
July 19–31	21	5.8	9.86	254
August	61	4.4	16.3	1,000
September	98	6.5	32.8	1,950
October	67	2.6	12.6	775
November	26	1.8	8.88	528
December	38	0.9	11.2	689

NORTH FORK OF KAUKONAHUA STREAM NEAR WAHIAWA, OAHU.

The North Fork of Kaukonahua Stream is on public and private land just north of the United States military reservation. The records on this stream have been obtained by the Engineer Corps of the United States Army, and have been furnished to the Geological Survey through the courtesy of Capt. A. B. Putnam.

Daily discharge, in second-feet, of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for 1911.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	.....	11	.....	42	21	38	129
2	.....	.....	12	.....	102	22	21	204
3	.....	.....	13	.....	16	23	17	.....
4	.....	.....	14	.....	10	24	14	.....
5	.....	.....	15	.....	21	25	11	.....
6	.....	.....	16	.....	18	26	18	.....
7	.....	.....	17	.....	46	27	42	.....
8	.....	.....	18	.....	128	28	34	.....
9	.....	11	19	.....	37	29	34	.....
10	.....	13	20	68	43	30	.....	.....
						31	.....	.....

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in gallons per 24 hours.

WAHIAWA RESERVOIR DITCH NEAR WAHIAWA, OAHU.

The Wahiawa reservoir ditch diverts water from Kaukonahua Stream below the Wahiawa reservoir. This ditch is used for irrigating the higher level cane fields of the Wailua Agricultural Co. The Wahiawa Water Co. has established a 10-foot weir on this ditch near its head and obtains gage-height records by means of a clock register. On account of excessive wave action in the channel above the weir, the conditions for accurate measurements are poor. Current-meter measurements show that the weir determinations are too small at practically all stages on account of this wave action.

The records at this weir for 1910–11 have been furnished to the Geological Survey through the courtesy of Mr. W. M. Templeton, manager of the Wahiawa Water Co. These records show the amount of water impounded by the Wahiawa reservoir at the junction of the two forks of Kaukonahua Stream.

Daily discharge, in second-feet, of Wahiawa reservoir ditch near Wahiawa, Oahu, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	5.4	13	42	25	44	29	55	69	67	36	68	72
2	5.4	22	39	28	44	33	62	71	67	0.0	43	61
3	5.4	23	36	13	50	37	65	69	63	35	5.8	40
4	3.0	26	31	31	54	34	41	62	78	59	5.8	13
5	1.3	25	23	31	55	33	41	54	78	60	5.8	40
6	1.4	3.0	16	36	42	34	57	45	78	56	4.8	49
7	5.6	7.9	27	34	37	51	67	44	78	68	1.9	40
8	5.6	18	24	33	33	50	67	63	78	63	12	41
9	5.8	19	27	38	47	34	72	69	75	1.5	12	48
10	5.8	21	27	38	49	38	78	66	49	50	7.1	50
11	5.8	22	29	45	41	55	78	63	51	65	8.4	18
12	5.9	3.2	33	41	40	58	78	71	51	73	15	54
13	6.1	3.4	33	47	53	45	78	78	51	77	6.8	54
14	6.2	3.5	34	51	52	31	78	75	60	77	32	53
15	6.4	3.5	39	49	55	34	78	71	73	81	54	53
16	6.4	12	43	48	57	36	78	78	64	60	53	53
17	6.5	12	43	45	57	53	78	78	69	78	59	53
18	6.5	17	42	37	55	48	78	77	10	78	68	51
19	6.6	15	47	37	36	50	78	77	49	78	64	57
20	4.3	5.0	35	34	24	59	64	77	54	78	40	69
21	4.2	18	37	38	38	47	59	62	23	78	52	69
22	4.2	20	39	44	37	39	67	60	35	78	71	68
23	4.2	27	47	44	49	46	78	71	35	78	65	59
24	4.2	32	32	38	44	40	78	78	19	78	42	58
25	4.2	34	34	23	48	55	78	51	0.0	78	75	17
26	4.2	35	45	24	50	58	73	22	33	78	68	18
27	4.2	7.0	48	28	36	59	64	31	50	89	23	35
28	4.2	33	53	36	51	45	59	60	48	101	44	24
29	4.2	.....	41	46	51	47	57	63	38	101	58	28
30	4.2	.....	13	44	49	50	66	67	18	61	49	23
31	4.2	.....	19	.....	29	.....	67	67	.....	66	.....	6.6
1911.												
1	6.6	9.7	16	27	44	36	52	66	63	30	34	44
2	6.6	11	18	10	51	31	53	68	62	50	66	48
3	13	12	19	24	53	34	50	69	60	52	42	18
4	17	6.9	19	24	49	25	24	68	55	56	20	42
5	14	5.8	9.1	23	51	33	50	68	62	53	19	54
6	6.3	8.6	39	31	48	42	64	58	62	53	50	54
7	6.3	9.2	47	37	31	47	63	51	61	53	67	49
8	6.3	11	47	43	49	36	62	67	61	44	62	39
9	12	13	44	27	63	42	62	66	61	54	47	31
10	10	9.2	40	50	61	50	62	66	60	55	54	12

Daily discharge, in second-feet, of Wahiawa reservoir ditch near Wahiawa, Oahu, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
11	4.0	9.3	34	55	56	38	51	66	60	66	48	30
12	4.0	3.6	31	55	49	49	70	59	61	68	35	33
13	4.1	9.9	50	48	57	47	70	58	61	69	37	26
14	4.1	9.0	64	30	52	41	70	67	57	69	51	36
15	4.2	11	61	33	47	46	69	67	61	63	55	32
16	12	11	57	44	41	48	69	67	61	58	54	31
17	11	14	38	30	38	51	60	58	61	69	56	9.0
18	6.5	19	41	38	59	43	64	51	58	68	56	30
19	6.5	6.0	48	38	62	58	71	59	54	68	27	34
20	15	31	66	27	50	59	71	45	61	67	44	30
21	17	37	65	36	28	59	71	61	54	67	43	30
22	3.4	44	34	38	37	58	70	69	45	42	34	19
23	15	59	25	28	36	58	70	69	41	57	45	8.8
24	22	33	37	28	48	55	70	69	34	70	58	8.8
25	6.7	17	49	26	55	38	69	68	34	70	42	8.8
26	6.7	12	41	45	55	55	69	68	44	69	24	12
27	8.8	13	38	42	48	55	69	68	43	69	37	13
28	5.0	13	31	48	25	58	68	68	47	65	48	12
29	12	.....	40	51	41	60	68	67	59	45	49	13
30	16	.....	36	42	37	58	67	67	53	60	25	12
31	14	.....	25	.....	40	.....	67	52	.....	67	.....	9.0

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in million gallons per 24 hours. The figures are based on weir measurements and are probably too low. What current-meter measurements have been made gave a discharge from 6 to 10 per cent greater than the weir, the percentage difference being greatest at the lower heads.

Monthly discharge of Wahiawa reservoir ditch near Wahiawa, Oahu, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	6.6	1.3	4.89	301
February	35	3.0	17.2	955
March	53	13	34.8	2,140
April	51	13	36.9	2,200
May	57	24	45.4	2,790
June	59	29	44.3	2,640
July	78	41	68.3	4,200
August	78	22	64.2	3,950
September	78	.00	51.4	3,060
October	101	.00	66.4	4,080
November	75	1.9	37.1	2,210
December	72	6.6	44.3	2,720
The year	101	.00	43.1	31,200
1911.				
January	22	3.4	9.55	587
February	59	3.6	16.0	889
March	66	9.1	39.0	2,400
April	55	10	35.9	2,140
May	62	25	47.1	2,900
June	60	25	47.0	2,800
July	71	24	63.4	3,900
August	69	45	63.5	3,900
September	62	34	55.2	3,280
October	70	30	59.5	3,660
November	67	19	44.3	2,640
December	54	8.8	26.6	1,640
The year	71	3.4	42.4	30,700

WAIANAE STREAM BASIN.

Waianae basin is on the southern slope of the Waianae Mountains. It is 2 or 3 miles wide and 5 or 6 miles long. The upper part of the basin terminates in cliffs which resemble those on the east side of the Koolau Mountains. At the foot of these cliffs is a sort of talus with considerable forest cover. Tunnels have been driven in this talus in order to obtain water for power and irrigation. Most of these tunnels as a rule are only a few hundred feet long and each furnishes on an average about 0.5 second-foot.

The water from all the tunnels is collected through pipes and flumes and is used first to develop electric power and afterwards to irrigate the lower lands. The power is used chiefly for pumping underground water near sea level. During 1911 measurements were made of the water carried by the various tunnels. Measurements were also made of the streams and ditches in the Waianae Valley. They are arranged in order downstream.

Miscellaneous measurements in Waianae Valley drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
June 23	West Fork	Waianae Stream	Just below pipe intake for power	0.45
23	do	do	Otrimba place, about 1½ miles below pipe intake.	.45
24	Waianae Stream	Pacific Ocean	Above dam at Puea	[a]1.08
28	do	do	do	[b]1.54
28	do	do	Below Otrimba place, above all diversions.	.86
23	Mauka tributary	Waianae Stream	Makia place, on west side	.17
23	Makai tributary	do	do	.24
28	do	do	do	.20
23	Tunnel 1	do	Waianae-uka, near mountain house	.98
23	Tunnel 2	do	do	[c].04
23	Tunnel 3	do	do	.23
23	do	do	do	[d].22
23	Tunnel 4	do	do	.35
23	Tunnel 5	do	do	.14
23	Tunnel 6	do	do	.69
29	Tunnel 7	do	do	1.27
28	Tunnel 8	do	Near mango tree above Puea Dam	.09
23	Power flume	Tunnels 1, 2, 3, 7	Above intake box of pressure pipe	2.26
24	Power ditch	Tunnels 1-7	Just below power house	3.47
28[e]	Ancient Auwai	Waianae Stream	Forks of road below power house	4.67
28[e]	do	do	Brown's house	4.72
28[e]	do	do	Lower reservoir	5.05

[a] Small taro ditches running above.
[b] Taro ditches shut off.
[c] Estimated.
[d] Duplicate measurement.
[e] Measurements for seepage made in order upstream. Results completely vitiated by decreasing flow from reservoir supplying ditch. The actual loss was undoubtedly large.

KAIPAPAU STREAM BASIN.

KAIPAPAU STREAM NEAR HAUULA, OAHU.

Kaipapau Stream rises near the crest of Koolau Range, and flows to sea in the district of Koolauloa on the windward side of the island. Its headwaters lie between Kaluanui on the east and Waialua on the

west, at a distance of about 4 miles from the ocean. Back of Kaluanui and Hauula the stream flows northward for several miles, then turns northeastward to the sea, which it enters about 2 miles south of Laie.

Weir records were kept on this stream at an elevation of 1,900 feet by W. E. Rowell from October, 1906, to October, 1907, inclusive, for J. B. Castle, who has furnished the records to the Geological Survey.

Monthly discharge of Kaipapau Stream at elevation 1,900 feet near Hauula, Oahu, for 1906–7.

Month.	Mean discharge.		Run-off in acre-feet.
	Million gallons daily.	Second-feet.	
1906.			
October	0.71	1.1	67.6
November	.65	1.0	59.5
December	1.41	2.2	135
1907.			
January	1.22	1.9	117
February	.86	1.3	72.2
March	.86	1.3	79.9
April	.53	.8	47.6
May	.38	.6	36.9
June	.90	1.4	83.3
July	.74	1.1	67.6
August	1.56	2.4	148
September	.76	1.2	71.4
October	.54	.8	49.2

NOTE.—Discharge obtained by means of a 15-inch weir notch 1 foot in depth. For days on which the discharge exceeded 4.16 second-feet, corresponding to 1-foot head, the excess was discarded. Excess discharge discarded as follows: December, 4 days; January, 7 days; March, 4 days; April, 2 days; May, 2 days; July, 1 day; August, 9 days; September, 1 day; October, 2 days.

KALUANUI STREAM BASIN.

KALUANUI STREAM NEAR HAUULA.

Kaluanui Stream rises in the Koolau Range south of Kaipapau and north of Punaluu, and flows to sea in the Koolauloa district, on the windward side of the island. The stream has a number of branches in its upper reaches which unite some miles from the sea and pass down a narrow deep gorge over a succession of waterfalls. The lower falls are called Kalihiwaa, and are very beautiful. Some distance below these falls water is diverted for irrigating cane and rice.

Weir records on this stream were maintained by W. E. Rowell for J. B. Castle at 2,500 feet elevation from November, 1906, to October, 1907, inclusive, and at 1,900 feet elevation from October, 1906, to October, 1907, inclusive. These records have been furnished to the Geological Survey by Mr. Castle.

Monthly discharge of Kaluanui Stream at elevation 1,900 feet, near Hauula, Oahu, for 1906–7.

Month.	Mean discharge.		Run-off in acre-feet.
	Million gallons daily.	Second-feet.	
1906.			
October	2.49	3.9	240
November	1.69	2.6	155
December	3.45	5.3	326
1907.			
January	2.84	4.4	270
February	2.14	3.3	183
March	2.16	3.3	203
April	1.45	2.2	131
May	1.08	1.7	104
June	2.29	3.5	208
July	2.02	3.1	191
August	3.50	5.4	332
September	2.05	3.2	190
October	1.52	2.4	148

NOTE.—Discharge obtained by means of a 30-inch weir notch 1 foot in depth. For days on which the discharge exceeded 8.33 second-feet, corresponding to 1-foot head, the excess was discarded. Excess discharge discarded as follows: October, 6 days; November, 5 days; December, 8 days; January, 9 days; February, 3 days; March, 5 days; April, 2 days; May, 2 days; June, 1 day; July, 2 days; August, 10 days; September, 3 days; October, 2 days.

Monthly discharge of Kaluanui Stream at elevation 2,500 feet, near Hauula, Oahu, for 1906–7.

Month.	Mean discharge.		Run-off in acre-feet.
	Million gallons daily.	Second-feet.	
1906.			
November	1.32	2.0	119
December	2.71	4.2	258
1907.			
January	1.92	3.0	184
February	1.22	1.9	106
March	1.31	2.0	123
April	.93	1.4	83.3
May	.60	.9	55.3
June	1.22	1.9	113
July	1.22	1.9	117
August	2.25	3.5	215
September	1.33	2.1	125
October	.96	1.2	73.8

NOTE.—Discharge obtained by 15-inch weirs on three separate branches of the stream. The figures given are the sum of the discharge of the three branches at 2,500 feet elevation.

MISCELLANEOUS MEASUREMENTS IN KALUANUI BASIN.

The following miscellaneous measurements on Kaluanui Stream and Kaluanui ditch were made in 1911:

Miscellaneous measurements in Kailuanui Stream drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Oct. 25	Kaluanui Stream	Pacific Ocean	Short distance below Kalihi-waa Falls and above diversions.	3.23
25	do	do	Below ditch on north side	.68
25	Kaluanui ditch	Kaluanui Stream	Below intake on north side	2.59

NOTE.—Water from this stream is used for irrigating cane. The stream practically disappears before entering the ocean.

PUNALUU STREAM BASIN.

PUNALUU STREAM NEAR HAUULA.

Punaluu Stream rises at the crest of the Koolau Range opposite upper Wahiawa and flows northeastward through the Koolauloa district to the sea. The Punaluu basin lies south of Kaluanui basin and north of Kahana basin and broadens out into a considerable valley which extends back several miles from the ocean. The lower part of the valley is somewhat swampy, and is devoted to rice growing, though some of the rice lands have been abandoned in recent years.

Weir records were kept on Punaluu Stream at elevation 2,500 feet by W. E. Rowell for J. B. Castle from October, 1906, to October, 1907, inclusive, and the results have been furnished to the Geological Survey by Mr. Castle.

Monthly discharge of Punaluu Stream at elevation 2,500 feet, near Hauula, Oahu, for 1906–7.

Month.	Mean discharge.		Run-off in acre-feet.
	Million gallons daily.	Second-feet.	
1906.			
October	0.36	0.6	37
November	.37	.6	36
December	.76	1.2	74
1907.			
January	.59	.9	55
February	.26	.4	22
March	.29	.4	28
April	.21	.3	20
May	.11	.2	11
June	.22	.4	21
July	.29	.4	27
August	.50	.8	49
September	.29	.3	18
October	.21	.3	20

NOTE.—Discharge obtained by means of a 15-inch weir.

MISCELLANEOUS MEASUREMENTS IN PUNALUU BASIN.

The following measurements have been made on the stream and ditches in the lower part of Punaluu basin. They are arranged in order downstream.

Miscellaneous measurements in Punaluu Valley drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Oct. 26	Punaluu Stream	Pacific Ocean	Above all present diversions	24.0
26	do	do	Below railroad bridge	22.2
26	Ditch No. 1	Punaluu Stream	Near intake on south side	19.8
26	do	do	Below railroad near beach	5.9
26	Ditch No. 2	do	Near intake on north side	3.75
27	do	do	Railroad crossing	1.13
26	Ditch No. 3	do	Intake on north side	1.63
27	do	do	Railroad crossing	.73
27	Ditch No. 4 [a]	do	Intake near railroad crossing	.25

[a] This ditch is used for irrigating sugar cane; capacity a little more than a second-foot.

NOTE.—Ditches are numbered in order downstream. The intake of ditch No. 1 is a mile or more above the mouth of the stream. On the north side of the stream is an old ditch at a higher level than the present ditches, which was formerly used for irrigating cane. Its capacity was about 6 second-feet at the intake. The total flow of the stream and ditches at the mouth at the time of measurement was 30.2 second-feet. This is probably somewhat above the normal on account of rain on the night of October 25.

KAHANA STREAM BASIN.

Kahana basin lies on the eastern slope of Koolau Mountains, south of Punaluu basin and north of Waikane basin. It is 2 or 3 miles wide and 4 or 5 miles long. The main stream is formed by a number of branches which unite in the upper part of the basin. The water is used to irrigate rice lands in the lower part of the valley.

During 1911 measurements were made on the stream and ditches in this basin. They are arranged in order downstream.

Miscellaneous measurements in Kahana Valley drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Oct. 27	Kahana Stream	Pacific Ocean	Just below intake of upper ditch on north side.	32.2
27	Ditch No. 1	Kahana Stream	Intake on north side	4.57
27	Old ditch	do	Intake on south side	0.00

NOTE.—Ditches numbered in order downstream. Water in ditch No. 1 used for taro. A considerable part of the lower end of the valley consists of swamp land and abandoned rice fields.

WAIKANE STREAM BASIN.

Waikane basin lies south of the Kualoa Ridge, which branches off from the main range to the east and north of Waiahole basin. The main stream is formed by several branches which originate in springs at about 1,000 feet elevation. The water is used to irrigate rice lands in the lower part of the valley. During 1911 the following miscellaneous measurements on streams and ditches were made in this basin. They are arranged in order downstream.

Miscellaneous measurements in Waikane Stream drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Oct. 9	Waikane Stream	Pacific Ocean	Above all diversions, about 2 miles from the mouth.		9.3
9	do	do	Government road, near ocean.		5.1
20	do	do	About half a mile from mouth.	1.05	6.2
Nov. 23	do	do	do	1.05	4.89
Oct. 9	Ditch No. 1	Waikane Stream	Intake on north side		2.46
20	do	do	About half a mile from ocean [a]		1.25
Nov. 23	do	do	do		.67
Oct. 9	Ditch No. 2 [b]	do	Near intake on south side		4.84
9	Ditch No. 3	do	Government road on north side.		[c] 1.00

[a] Measurement made near Japanese hut below small diversion to the south.
[b] Ditch used to carry water to rice mill near public road.
[c] Estimated.

NOTE.—Ditches numbered in order downstream.

WAIAHOLE STREAM BASIN.

GENERAL FEATURES.

Waiahole basin lies on the eastern slope of Koolau Range, south of Waikane basin and north of Kaalaea basin. All the upper part of the basin is held in public ownership, but the lower part is in private ownership. There are two branches of the main stream, Halona on the south and Waihi on the north, with another tributary from the north, Waianu Stream, farther down. Uwau Stream is tributary to Waianu Stream on the north. All these streams rise in springs which are about 1,000 feet above sea level, and the flow is fairly constant. A part of the water is used for irrigating rice and taro lands in the lower part of the valley.

WAIAHOLE STREAM AT MANIANIAULA, NEAR WAIKANE, OAHU.

A gaging station was established on Waiahole Stream at Manianiaula, about 2 miles from the sea, September 25, 1911.

A staff gage, graduated to tenths of a foot and fastened to the right bank, is used for obtaining gage heights.

It is probable that there has been some change in the controlling section since the gage was established, owing to the character of the stream bed and the steep grade at this place.

The discharge at this station, which is on public land just above the lower boundary, shows the total quantity of water furnished by this stream above all diversions.

Discharge measurements of Waiahole Stream at Manianiaula, near Waikane, Oahu, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 10	Martin and Schulz	21.0	34.6	.....	27.9
30	H. R. Schulz	14.2	13.1	0.99	27.6
Oct. 2	.....do	16.5	21.1	1.00	27.4
13	.....do	16.3	20.1	.99	24.6
Nov. 22	.....do	13.6	18.7	1.00	25.4

NOTE.—Several additional measurements made early in 1912 were used in determining the rating. Measurements made by wading at various sections.

Daily gage height, in feet, of Waiahole Stream at Manianiaula, near Waikane, Oahu, for 1911.

[Peleioholani, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.10	1.00	1.00	16	.....	1.00	1.00	1.02
2	.....	1.00	1.00	1.00	17	.....	1.00	1.00	1.00
3	.....	1.00	1.00	1.00	18	.....	1.00	1.00	1.00
4	.....	1.00	1.00	1.00	19	.....	1.00	1.00	1.00
5	.....	.99	1.00	1.00	20	.....	1.00	1.00	1.00
6	.....	.99	1.00	1.00	21	.....	1.00	1.00	1.00
7	.....	.99	1.00	1.00	22	.....	1.00	1.00	1.00
8	.....	.99	1.00	1.00	23	.....	1.00	1.00	1.00
9	.....	.99	1.00	1.15	24	.....	1.00	1.00	1.00
10	.....	.99	1.00	1.00	25	1.10	1.00	1.01	1.00
11	.....	.99	1.00	1.00	26	1.00	1.00	1.00	1.00
12	.....	.99	1.00	1.00	27	.97	1.00	1.00	1.02
13	.....	.99	1.00	1.00	28	.95	1.00	1.02	1.00
14	.....	.99	1.00	1.00	29	.95	1.00	1.00	1.00
15	.....	1.00	1.00	1.00	30	.99	1.00	1.00	1.00
					31	.....	1.00	.....	1.00

Daily discharge, in second-feet, of Waiahole Stream at Manianiaula, near Waikane, Oahu, for 1911.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	44	27	27	16	.....	27	27	29
2	.....	27	27	27	17	.....	27	27	27
3	.....	27	27	27	18	.....	27	27	27
4	.....	27	27	27	19	.....	27	27	27
5	.....	25	27	27	20	.....	27	27	27
6	.....	25	27	27	21	.....	27	27	27
7	.....	25	27	27	22	.....	27	27	27
8	.....	25	27	27	23	.....	27	27	27
9	.....	25	27	54	24	.....	27	27	27
10	.....	25	27	27	25	44	27	28	27
11	.....	25	27	27	26	27	27	27	27
12	.....	25	27	27	27	23	27	27	29
13	.....	25	27	27	28	22	27	29	27
14	.....	25	27	27	29	22	27	27	27
15	.....	27	27	27	30	25	27	27	27
					31	.....	27	.....	27

NOTE.—Daily discharge computed from a poorly defined rating curve.

Monthly discharge of Waiahole Stream at Manianiaula, near Waikane, Oahu, for Sept. 25 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
September 25–30	44	22	27.1	322	C.
October	44	25	26.9	1,650	C.
November	29	27	27.1	1,610	C.
December	54	27	28.0	1,720	C.

WAIAHOLE STREAM AT WAIAHOLE, NEAR WAIKANE, OAHU.

A gaging station was established on Waiahole Stream about 100 feet above the bridge at Waiahole, September 25, 1911.

A staff gage graduated into tenths of feet and fastened to the left bank is used for obtaining gage heights. It is possible that there may have been some change in the controlling section since the gage was established, due to the nature of the stream bed at this place. The discharge at this station shows the amount of water going to sea through Waiahole Stream below all diversions.

Discharge measurements of Waiahole Stream at Waiahole, near Waikane, Oahu, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 9	Martin and Schulz	23	23.1	.....	38.3
10	do	15	19.4	.....	37.8
20	W. F. Martin	15.3	18.3	.....	37.6
20	H. R. Schulz	25.7	23.7	.....	38.0
25	do	28.4	28.9	1.32	55.9
25	do	28.4	27.4	1.23	46.2
Oct. 8	do	28.0	28.2	1.22	40.3
12	do	27.7	28.1	1.22	37.1
Nov. 23	do	27.0	28.4	1.22	35.5

NOTE.—Several additional measurements made early in 1912 were used in determining the rating. Measurements made by wading at various sections.

Daily gage height, in feet, of Waiahole Stream at Waiahole, near Waikane, Oahu, for 1911.

[Eddie Leialoha, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.70	1.28	1.25	16	.....	1.28	1.25	1.25
2	.....	1.30	1.28	1.25	17	.....	1.28	1.25	1.25
3	.....	1.23	1.28	1.25	18	.....	1.28	1.25	1.28
4	.....	1.22	1.28	1.25	19	.....	1.28	1.25	1.30
5	.....	1.22	1.25	1.25	20	.....	1.28	1.25	1.30
6	.....	1.22	1.25	1.25	21	.....	1.28	1.25	1.25
7	.....	1.22	1.25	1.25	22	.....	1.28	1.25	1.25
8	.....	1.22	1.25	1.25	23	.....	1.28	1.25	1.25
9	.....	1.22	1.25	1.25	24	.....	1.40	1.25	1.30
10	.....	1.22	1.25	1.25	25	1.34	1.30	1.25	1.30
11	.....	1.22	1.25	1.30	26	1.20	1.28	1.25	1.35
12	.....	1.25	1.25	1.25	27	1.19	1.30	1.25	1.28
13	.....	1.25	1.28	1.25	28	1.18	1.28	1.25	1.25
14	.....	1.28	1.25	1.25	29	1.18	1.28	1.25	1.30
15	.....	1.28	1.25	1.30	30	1.24	1.28	1.25	1.28
					31	.....	1.28	.....	1.30

Daily discharge, in second-feet, of Waiahole Stream at Waiahole, near Waikane, Oahu, for 1911.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		130	49	44	16		49	44	44
2		52	49	44	17		49	44	44
3		41	49	44	18		49	44	49
4		39	49	44	19		49	44	52
5		39	44	44	20		49	44	52
6		39	44	44	21		49	44	44
7		39	44	44	22		49	44	44
8		39	44	44	23		49	44	44
9		39	44	44	24		70	44	52
10		39	44	44	25	59	52	44	52
11		39	44	52	26	36	49	44	61
12		44	44	44	27	35	52	44	49
13		44	49	44	28	33	49	44	44
14		49	44	44	29	33	49	44	52
15		49	44	52	30	42	49	44	49
					31		49		52

NOTE.—Daily discharge computed from a fairly well defined rating curve.

Monthly discharge of Waiahole Stream at Waiahole, near Waikane, Oahu, for Sept. 25 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
September 25-30	59	33	39.7	472	B.
October	130	39	49.4	3,040	B.
November	49	44	44.8	2,670	B.
December	61	44	47.1	2,900	B.

WAIHI STREAM NEAR WAIKANE, OAHU.

Waihi Stream is one of the main branches of Waiahole Stream. Its flow is practically constant. During the latter part of 1911 a few measurements were made on this stream at 750 feet elevation which show its ordinary flow.

Daily discharge, in second-feet, of Waihi Stream at elevation 750 feet, near Waikane, Oahu, for 1911.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1			3.8	16			3.8
2			3.8	17			3.8
3			3.8	18			3.8
4			3.8	19			3.8
5			3.8	20			
6			3.8	21		4.6	
7			3.8	22		4.4	
8			3.8	23		4.2	
9			3.8	24		4.0	
10			3.8	25		4.0	
11	3.7		3.8	26		4.0	
12	3.7		3.8	27		3.8	
13			3.8	28		3.8	
14			3.8	29		3.8	
15			3.8	30		3.8	
				31			

NOTE.—Discharge based on several measurements and gage heights for the days given, except for the period Sept. 22-25, which has been estimated.

HALONA STREAM NEAR WAIKANE, OAHU.

Halona Stream is the chief branch of Waiahole Stream. It rises in springs at elevation about 1,000 feet and has a very uniform flow. During the later part of 1911 several measurements were made on this stream at elevation 750 feet, which show the ordinary flow.

Daily discharge, in second-feet, of Halona Stream at elevation 750 feet, near Waikane, Oahu, for 1911.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1			10	16			
2			10	17			
3			9.0	18			
4			9.0	19			
5			9.0	20			
6			9.0	21		11	
7			9.0	22		10	
8			9.0	23		10	
9	9.0		9.0	24		10	
10	9.0		9.0	25		9.0	
11			9.0	26		9.0	
12			9.0	27		9.0	
13			9.0	28		9.0	
14			9.0	29		9.0	
15			9.0	30		9.0	
				31			

NOTE.—Discharge based on several measurements made by meter and weir, and daily gage heights for the days given, except for the period Sept. 22–26, which has been estimated.

WAIANU STREAM NEAR WAIKANE, OAHU.

Waianu Stream is tributary to Waiahole Stream from the north about 1 mile above the mouth.

A temporary gaging station was established on this stream above all the main diversions September 28, 1911. This station is a short distance below Uwau tributary and above the main Waianu ditch. The stream is uniform in flow, being fed by springs at about 1,000 feet elevation. The few observations made in 1911 show the ordinary flow of this stream.

Daily discharge, in second-feet, of Waianu Stream above main ditch, near Waikane, Oahu, for 1911.

Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.
1		12		16		12	
2		15		17			
3		14		18			
4		13		19			
5		13		20			
6		13		21			
7		13		22			1
8		13		23			
9	13	12		24			
10	13	12		25			
11		12		26			
12		12		27			
13		12		28	12		
14		12		29	12		
15		12		30	12		
				31			

NOTE.—Discharge based upon three measurements and gage heights for the days given.

Miscellaneous measurements in Waianu Stream drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Sept. 9	Waianu Stream	Waiahole Stream	Camp above Uwau		13.2
9	do	do	Just above intake Ditch No. 1, on north side.		13.2
30	do	do	do	1.10	12.3
Nov. 22	do	do	do	1.09	11.9
Sept. 10	do	do	Above junction with Waiahole		11.0
Oct. 4	do	do	do		12.9
Sept. 9	Uwau	Waianu Stream	Above mouth		1.99
Oct. 11	do	do	do		2.21
11	South Fork of Waianu Stream.	do	About 650 feet elevation		1.86
11	Middle Fork of Waianu Stream.	do	do		4.22
11	North Fork of Waianu Stream.	do	do		2.33
Sept. 9	Ditch No. 1	do	Intake on north side		8.6
9	do	do	About 1,000 feet below intake		5.6
10	do	do	Road crossing on ridge		1.46
Oct. 14	do	do	Intake on north side		7.1
14	do	do	About 1,000 feet below intake		5.1
Sept. 9	Ditch No. 3	do	Intake south side		.37
Oct. 14	do	do	do		.40
Sept. 9	Ditch No. 4	do	Intake on south side		.68
Oct. 14	do	do	do		.29
Sept. 9	Ditch No. 5	do	do		1.13

NOTE.—Waianu Stream is formed by South, Middle, and North forks. Uwau is a tributary from the north, entering above Ditch No. 1. Ditches are numbered in order downstream.

MISCELLANEOUS MEASUREMENTS IN WAIAHOLE BASIN.

During 1911 a large number of miscellaneous measurements were made on the streams and ditches in Waiahole basin. These measurements are arranged in order downstream.

Miscellaneous measurements in Waiahole Stream drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Sept. 9	Waiahole Stream	Pacific Ocean	About 2,000 feet above junction with Waianu Stream.		19.5
Oct. 13	do	do	do		18.9
Sept. 9	do	do	About 100 feet below junction with Waianu Stream.		32.3
10	do	do	Just above intake of second ditch on south side.		26.7
10	do	do	Just above junction with Waianu Stream.		22.2
Oct. 14	do	do	do		22.2
Sept. 21	Halona Stream	Waiahole Stream	Old weir at elevation 700 feet		11.6
29	do	do	Old weir at elevation 700 feet	.95	9.0
21	Waihi Stream	do	Old weir at elevation 750 feet		[a] 4.6
29	do	do	do		[a] 3.8
Oct. 3	No. A ditch [b]	do	Just below Manianiaula on south side.		10.4
Sept. 10	Ditch No. 1	do	Just below Manianiaula on north side.		15.6
10	do	do	About 1,000 feet below intake		2.77
Oct. 13	do	do	do		3.40
6	do	do	Intake below Manianiaula		10.1
Sept. 10	Ditch No. 2	do	Intake on south side		9.6
10	do	do	House under mango tree about 500 feet from mouth of Waianu Stream.		6.4

[a] Weir measurements corrected for leakage.
[b] This ditch returns to stream a short distance below intake.

Miscellaneous measurements in Waiahole Stream drainage basin in 1911—Continued.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Gage height.	Discharge
				Feet.	*Sec.-ft.*
Oct. 6	Ditch No. 2	Waiahole Stream	Intake on south side		6.6
Sept. 10	Ditch No. 3	do	Near intake about 1,000 feet below junction of Waiahole and Waianu Streams.		.41
Oct. 6	do	do	do		.18
Sept. 20	Ditch	do	Government road on south side.		1.01
26	do	do	Near Government road on north side.		1.40

NOTE.—The Halona on the south and the Waihi on the north unite to form the Waiahole. Ditches are numbered in order downstream. No. A ditch is the highest.

KANEOHE STREAM BASIN.

Kaneohe basin is on the eastern slope of the Koolau Mountains south of Heeia and north of Kailua basins. It lies opposite Nuuanu and Kalihi basins on the west side of the range. The main stream is formed by several branches which rise in springs at elevation about 800 or 900 feet. During 1911 measurements were made on the streams and ditches in this basin at various points.

Miscellaneous measurements in Kaneohe Stream drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Nov. 5	South Branch	Kaneohe Stream	Below intake of ditch No. 1 and above junction with North Branch.	3.62
5	North Branch	do	Above junction with South Branch	3.27
5	Kaneohe Stream	Pacific Ocean	Road above No. 2 ditch and below second tributary on the left.	10.2
3	do	do	Below intake of ditch No. 2	8.5
3	do	do	Above Parker Stream, near Government road.	5.1
7	do	do	do	3.55
4	Parker Stream	Kaneohe Stream	Above all ditches	.52
4	do	do	Just above Government road	1.94
5	First tributary	do	Above junction with Kaneohe	1.53
5	Second tributary	do	do	*a* .3
5	Ditch No. 1	do	Below intake on South Branch	2.04
3	Ditch No. 2	do	Below intake near mouth of second tributary.	2.72
6	do	do	do	2.60
3	do	do	Below inflow from No. 1 ditch	2.69
5	do	do	Government road	.87
3	Ditch No. 3	do	Intake below third tributary	.59
3	Ditch No. 4 *b*	do	Intake above Government road	6.9
7	do *b*	do	do	7.0
5	Ditch No. B	First tributary	Opposite mouth of first tributary	.57
5	Ditch No. C	do	do	.86
4	Ditch No. A	Third tributary	Intake	1.21
4	do	do	Below Parker Stream crossing	2.03
5	do	do	Above Government road	1.39

a Estimated. *b* This ditch supplies rice mill.

NOTE.—Tributaries enter from the north and are called first, second, and third in order downstream. Ditches from main stream are numbered in order downstream.

KAILUA STREAM BASIN.

Kailua basin is on the eastern slope of the Koolau Range, south of Kaneohe basin and north of Waimanalo basin. The main stream is made up of a large number of branches which originate in springs about 800 feet above sea level.

A part of the water in this basin is diverted into Waimanalo basin by the Waimanalo ditch, which intercepts all the upper streams about 600 or 700 feet above sea level. The ditch has a capacity of about 6 second-feet. The water in the lower part of the basin is used for irrigating rice lands, the surplus water entering Kawainui Lake and thence flowing to the sea. During 1911 the following measurements were made on the streams and ditches in this basin:

Miscellaneous measurements in Kailua Stream drainage basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Nov. 29	Middle Fork	Kailua Stream	Below road near Maunawili ranch	1.80
29	North Fork	do	do	1.40
29	South Fork	do	do	.87
29	Tributary [a]	do	do	1.21
29	Rice Mill ditch	do	Intake below junction of three forks	4.95
27	Maunawili ditch	Maunawili Spring	100 feet below spring in upper Kailua	1.00
28	Upper Kailua ditch	Kailua tributaries	North of Maunawili Stream	2.10
28	do	do	South of Ainone ditch	2.44
28	Ainone ditch	Ainone Stream	Between intake and Upper Kailua ditch.	.50
28	Upper Kailua ditch	Kailua tributaries	Below Ainone ditch	2.68
28	Makawao ditch	Makawao Springs	Between intake and Upper Kailua ditch.	.59
28	Makawao Stream	Kailua tributaries	Above Upper Kailua ditch	.63
28	Upper Kailua ditch	do	North of tunnel to Waimanalo basin	3.38

[a] This tributary enters the Kailua Stream from the north below intake for Rice Mill ditch.

NOTE.—The Upper Kailua ditch intercepts a number of spring-fed tributaries of the Kailua, and takes the water through the ridge south to Waimanalo basin.

WAIMANALO STREAM BASIN.

Waimanalo basin is on the eastern slope of the Koolau Range south of Kailua basin. A large part of the water used for irrigation is diverted by ditch from Kailua basin. During 1911 the following miscellaneous measurements were made in this basin:

Miscellaneous measurements in Waimanalo Stream basin in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Nov. 28	Upper Kailua ditch	Upper reservoir	Just above Waimanalo reservoir	4.42
28	No. 2 Spring	Upper Kailua ditch.	Above ditch north of Waimanalo reservoir	.55
28	No. 3 Spring	Upper reservoir	Just above reservoir	.22
28	No. 4 Spring	Reservoir ditch	Above ditch south of Waimanalo reservoir.	.32

NOTE.—The Upper Kailua ditch diverts water from upper Kailua Springs into Waimanalo basin, where the water of several other springs is also picked up. The ditch empties into Waimanalo reservoir.

GENERAL MISCELLANEOUS MEASUREMENTS.

Some other miscellaneous measurements on streams and ditches in Oahu were made in 1911 and are given below.

Miscellaneous measurements of streams and ditches on Oahu in 1911.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Discharge.
				Sec.-ft.
Aug. 29	Waimalu Stream	Pacific Ocean	Above all ditches near Aiea	0.42
29	Waimalu ditch [a]	Waimalu Stream	Below intake	.26
July 29	G 6 flume [b]	One pump	Lualualei Valley	3.08
29	do	Two pumps	do	5.90
Dec. 23	Makalapa ditch [c]	Pumps	Upper end of lined section near Puuloa railroad station.	16.6
23	do	do	Lower end of 2,000 feet of lining near Puuloa railroad station.	14.9
23	do	do	Below Pearl Harbor railroad crossing at end of 2,000 feet unlined ditch.	10.3
9	Puuloa ditch [c]	do	Below 10-foot weir near Aiea	30.4
Nov. 29	do	do	do	28.0
29	do	do	Just above Puuloa reservoir	26.6
29	Mill reservoir ditch [c]	do	Just below weir near Aiea	10.0
29	do	do	300 feet above reservoir	8.4
Dec. 9	Eleven-million-gallon ditch.[d]	do	200 feet below weir, near Aiea	16.4
9	do	do	Channel of approach 10 feet above weir.	16.6
13	No. 5 pump ditch [c]	do	Below end of lift pipe, near Waipahu	12.4
13	do	do	Flume No. 3, semicircular	10.8
13	do	do	Above No. 2 reservoir	8.8
14	East ditch pump 3 [e]	do	Below end of lift pipe, near Waipahu	8.3
14	West ditch pump 3 [e]	do	do	2.95
22	No. 5 pump ditch [c]	do	do	8.5
22	do	do	Flume 3, semicircular	7.4
22	do	do	Above No. 2 reservoir	7.0
19	do	do	At lower end of flume No. 1, near Ewa	16.7
19	do	do	Just above diversion into No. 5 reservoir.	[f] 16.8
19	do	do	Just below diversion into No. 5 reservoir.	6.1
19	do	do	Flume between fields 24 D and 15 A	5.8
19	do	do	Flume between fields 16 A and 17 A	5.5
19	do	do	Just above 6 B reservoir	5.5
Nov. 21	Wahiawa reservoir ditch.[g]	Wahiawa reservoir ditch.	Just below weir near Wahiawa; head, 1.282 feet.	50.6
22	do	do	Just below weir near Wahiawa; head, 0.471 foot.	11.7
23	do	do	Just below weir near Wahiawa; head, 0.716 foot.	21.5
23	do	do	Just below weir near Wahiawa; head, 0.984 foot.	35.0
23	do	do	Just below weir near Wahiawa; head, 1.156 feet.	43.0
23	do	do	Just below weir near Wahiawa; head, 1.474 feet.	62.7
21	do	do	Flume between tunnels 9 and 10	53.8
21	do	do	200 feet above lower weir	51.4
21	do	do	500 feet below lower weir	51.4
21	do	do	Above siphon across Poamoho Gulch	51.9
22	do	do	Flume 1,000 feet below Poamoho Gulch	53.5
22	do	do	Flume 8, in Helemano Gulch	51.9
22	do	do	400 feet above siphon across Helemano Gulch.	51.6
Aug. 11	Halona Stream	Waiahole Stream	About elevation 650 feet	[h] 8.5
11	Waihi Stream	do	About elevation 750 feet	[h] 3.7
11	Waianu 1 ditch	Waianu Stream	do	[h] .78
11	Waianu 2 ditch	do	do	[h] 3.4
11	Waianu 3 ditch	do	do	[h] 1.7
12	Waikekee ditch	Waikane Stream	do	[h] 1.2
12	Waikane ditch	do	do	[h] .46
12	do	do	do	[h] 2.2
17	Waiawa ditch	Waiawa Stream	Intake in Waiawa Gulch	[i] 5.3
17	do	do	Flume about 3 miles below intake	[i] 4.2

[a] Upper ditch from west side.
[b] Measurements made to determine the capacity of two small pumping units. Each unit consisted of a centrifugal pump with 90-foot lift, belt-driven from an 80-horsepower gas engine.
[c] Made to determine seepage losses.
[d] Made to correct weir for velocity of approach.
[e] Made to determine slippage in pump.
[f] Seepage into ditch from higher irrigated land.
[g] Made to rate 10-foot weir and determine seepage losses.
[h] Measurements by weirs put in by the engineers investigating the Oahu-Koolau ditch project.
[i] Float measurement of freshet water. Ditch carried about 0.5 second-foot on Aug. 16 and is dry or nearly so for most of the time.

SPRINGS AND ARTESIAN WELLS.

USE AND CHARACTER.

A large part of the water supply on the leeward side of Oahu comes from artesian wells. These are found around the south, west, and north sides of the island from Diamond Head to Kahana, but the greatest number have been developed in the Honolulu, Waipahu, and Ewa basins between Diamond Head and Honouliuli.

Three municipal pumping plants in Honolulu, located at Kaimuki, Beretania Street, and Kalihi, lift artesian water to reservoirs at elevations sufficient to serve a large part of the city. The sugar plantations and the rice growers at the lower elevations use large quantities of artesian water for irrigation.

Most of the wells that have been sunk on Oahu are flowing wells or flowed at the time of boring. Some of the older wells have ceased to flow, probably because of defective casings. The water in most of the wells rises to a height of from 30 to 34 feet above mean sea level, the height varying somewhat with the location of the well, and varying in the same well with the amount of rainfall in the mountains.

A large number of springs also appear at different elevations, the larger ones being found near sea level around Pearl Harbor.

During 1911 a number of measurements were made of the springs and flowing wells in and near Honolulu and around Pearl Harbor. The measurements are presented in the following tables and, for the wells, are arranged in the order of numbering of the wells. Some records of typical well borings are also presented to show the different formations encountered in sinking wells at different places on the island.

The Honolulu Plantation Co., the Oahu Sugar Co., the Ewa Plantation Co., and the Waialua Agricultural Co. have kindly furnished to the Geological Survey records of underground water pumped for irrigation.

Investigations have recently been undertaken by the Geological Survey looking toward the larger development and conservation of the artesian water supply of Oahu.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements have been made of springs and wells on Oahu Island:

Miscellaneous measurements of springs in and near Honolulu in 1911.

Date.	Spring.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
Sept. 17	Lagoon Fish Pond		Below Waialae road, west side of Manoa Valley.	3.91
17	Small springs		do	[a].05
Nov. 8	[a] Makiki	Makiki Stream	Upper end of valley, elevation about 800 feet.	.98
Apr. 7	[b] Kahuawai	Pauoa Stream	Under rose apple tree, upper end of Pauoa Valley.	.54
6	do	do	do	.50
June 7	do	do	do	.58
7	do	do	do	[c].60
Aug. 13	do	do	do	[c].50
Oct. 22	do	do	do	[c].50
29	do	do	do	[c].48
Nov. 5	do	do	do	[c].48
12	do	do	do	[c].48
19	do	do	do	[c].50
26	do	do	do	[c].50
Dec. 3	do	do	do	[c].48
10	do	do	do	[c].50
17	do	do	do	[c].48
24	do	do	do	[c].50
31	do	do	do	[c].50
Sept. 15	Johanthen		East of Houghteling residence, Honolulu.	1.06
15	Houghteling Residence		Near Houghteling residence, Honolulu.	.13
15	Pauoa Bridge		Honolulu	[a].20
15	Kahuniwai		Near Kumuhahana Spring and west of Liliha Street, Honolulu.	[d]1.52
15	Ah Yin		West of Ah Yin Pond, about half a mile east of Bishop Museum, Honolulu.	.85

[a] Estimated. [b] 1910. [c] 18-inch weir. [d] Two outlets.

Miscellaneous measurements of flowing wells in and near Honolulu in 1911.

Date.	Well.	Size (inches).	No.[a]	Locality.	Discharge.
					Sec.-ft.
Apr. 7	[b] Cleghorn	6	16	Cleghorn residence, Waikiki	[c]1.04
7	[b] do	6	16	do	[c]1.07
Dec. 5	do	6	16	do	.89
13	Flowing well [d]	10	22	200 feet below Waialae car line and 50 feet west of Manoa Stream, Waikiki.	[d]1.76
12	Kapahulu dairy	8	6	Kapahulu dairy, Waikiki	[e].10
June	Kapahulu dairy (United States).	12		Kapahulu road, about ½ mile south of Waialae car line.	[c]1.15
	do	12		do	[c]1.13
Dec. 13	Pumping station	8	11	Kaimuki pumping station	1.08
12	W. R. Castle	6	7	Kapahulu dairy, Waikiki	[f].41
12	Sing Loy		5	West of Kapahulu dairy and east of Palolo Stream.	1.51
12	Well	8	9	Banana and rice fields, east of Palolo Stream and south of Kaimuki pumping station.	.90
Sept. 17	Mohap		10	Near Kapahulu road, east of Palolo Stream and north of Sing Loy well.	[g].95
17	do		18	Near Mohap 10, but west of Palolo Stream.	.78
12	Lund Do Wai	12	19	East of Manoa Stream, near Lund Do Wai rice mill south of Waialae road.	2.73

[a] Refers to public works map, made under the direction of Marston Campbell, superintendent.
[b] 1910.
[c] Duplicate measurements.
[d] Without valve.
[e] Flow through broken valve only; other valve good, but measurement impossible.
[f] Float measurement.
[g] Water rises 25 feet above sea level.

Miscellaneous measurements of flowing wells in and near Honolulu in 1911.

Date.	Well.	Size (inches).	No.	Locality.	Discharge.
					Sec.-ft.
Sept. 11	Lund Do Wai		21	Mauka well, east of Manoa Stream	1.90
17	do		21	do	[a] 1.75
11	do		27	Just south of Lund Do Wai rice mill	1.80
12	do		26	Lund Do Wai rice mill	.55
11	do		28	Just northwest of Lund Do Wai rice mill	.67
Dec. 9	Sing Loy	6 or 8	36	¼ mile east of Pawaa Junction, east well	1.20
6	do	6 or 8	37	do	1.27
Sept. 17	do		38	do	[b] .87
Dec. 6	Sing Loy (St. Lawrence).		39 or 40	South of Pawaa Junction	[c] 1.12
9	Carter	6	31	Vacant lot on seaward side of Pawaa Junction.	.37
9	Liliuokalani		55	On King Street, west of Pawaa Junction	[d] 2.98
9	do		55	do	[e] 3.61
9	General Grant		56	do	.83
6	Lou Gawks		58	South of King Street, opposite Mrs. Gray's.	.57
Sept. 19	Ah Yin 1 [f]	12		Ah Yin rice mill, Honolulu	[g] 2.89
Dec. 7	do	12		do	[g] 2.79
7	do	12		do	[h] 2.70
7	do	12		do	[i] 2.65
7	do	12		do	[g] 2.75
7	do	12		do	[h] 2.69
7	do	12		do	[i] 2.62
7	do	12		do	[i] 2.58
18	do	12		do	[h] 2.82
18	do	12		do	[g] 2.82
18	Ah Yin 2	10		do	[h] 2.18
18	Ah Yin 3	8		do	[h] 1.78
18	Ah Yin 4	10		do	[h] 1.12
18	do	10		do	[i] 1.04
18	Ah Yin 1 and 2 [j]	12 and 10		do	[h] 4.89
18	do	12 and 10		do	[g] 4.86
18	do	12 and 10		do	[i] 4.70
18	Ah Yin, 1, 2, and 3 [j]	12, 10, and 8.		do	[h] 6.55
18	do	12, 10, and 8.		do	[g] 6.62
18	do	12, 10, and 8.		do	[i] 6.46
18	do	12, 10, and 8.		do	[i] 6.30
18	Ah Yin, 1, 2, 3, and 4 [q]	12, 10, 8, and 10.		do	[h] 7.67
18	do	12, 10, 8, and 10.		do	[g] 7.92
18	do	12, 10, 8, and 10.		do	[i] 7.32
Dec. 4	Well		117	In rice field at seaward end of Kalihi car line.	.57
4	Dowset		118	Above rice mill at end of Kalihi car line	.56
Oct. 18	Hoftailing (Damon)	10		Gasoline pump, Moanalua	2.79
18	Well 2 (Damon)	10		Swimming tank, Moanalua	1.30
Nov. 27	Valley (Damon)	12		Near Japanese tea gardens, Moanalua	[k] 2.40
18	Banana (Damon)	6		Upper end Moanalua Valley	.79
18	Damon-Dillingham	12		Electric pump, Moanalua	2.78
Nov. 28	Crater Lake	12		Salt Lake crater, Moanalua	2.50

[a] Water rises 24.9 feet above sea level.
[b] Water rises 31.6 feet above sea level.
[c] Includes flow from two wells.
[d] Usual flow, valve half open.
[e] Maximum flow, valve entirely open.
[f] Ten measurements with three different meters.
[g] Meter 762, rating gives too high a discharge by about 2 per cent.
[h] Meter 738.
[i] Meter 887, rating gives too low a discharge by about 2 per cent.
[j] Combined flow.
[k] Measurement by weir.

Miscellaneous measurements of springs around Pearl Harbor in 1911.

Date.	Spring.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
Sept. 13	Waiau rice mill	Pearl Loch	Near Waiau above rice mill and below Waiau Pond.	3.75
13	Culvert	do	West of Waiau at railroad culvert	4.93
14	Large	do	Near Waiau, but west of Culvert Spring at wooden bridge 100 feet below railroad.	37.8
14	Waiau	do	Between Waiau and Pearl City and west of large spring.	6.9
13	Waiawa Gulch	Waiawa Stream	Outlet north of Pearl City and west of Waiawa Gulch	.51
14	Spring		½ mile east of Pearl City	*a* .15
13	Waiawa rice mill		Rice mill west of Pearl City and north of railroad.	4.36
Dec. 21	Spring		½ mile east of Waipahu mill and 300 feet below road.	*b* 1.00
22	do		200 feet makai of Waipahu mill	.30
Sept. 14	Waipahu	Waipahu Stream	Waipahu Gulch near concrete-arch bridge on Government road.	3.19
Dec. 22	do	do	do	*c* 3.64
12	Waipahu Stream	Pearl Loch	Below concrete bridge on Government road in gulch near Waipahu Spring.	*d* 11.3

a Estimated.
b Estimated; no place for measurement.
c Conditions unfavorable for accurate measurement.
d Stream is made up by a series of springs below pumping stations in Waipahu Gulch. Below the point of measurement many other springs enter, so that the flow at Waipahu railroad station is probably 20 second-feet or more.

Miscellaneous measurements of wells around Pearl Harbor in 1911.

Date.	Well.	Size (inches).	No.[a]	Locality.	Discharge.
					Sec.-ft.
Aug. 29	Kalauao		171	Just north of Kalauao	0.48
Sept. 13	McCandless		173	Just below road in Waimalu Gulch	*b* 1.09
Aug. 29	do		173	do	1.70
29	Waimalu	10	174	Just north of the road in Waimalu Gulch.	*c*. 53
Dec. 19	do	10	174	do	1.05
19	Kitchen	8(?)	175	Chinese camp 200 feet above road in Waimalu Gulch.	.33
Aug. 31	Waiau	10	198	Below Government road and above Waiau Pond.	2.30
Dec. 19	do	10	198	do	1.95
19	Waiau rice mill	8	197	Above Waiau rice mill and west of Waiau Pond.	1.75
19	Yong See How	8	199	150 feet below railroad and ½ mile east of Pearl City.	.25
Aug. 31	do	8(?)	199(?)	do	.73
31	Pearl City mill		200	600 feet east of Pearl City	4.51
Sept. 13	do		200	do	4.30
Aug. 31	do		203	About ½ mile below Pearl City above rice mill and west of railroad.	1.65
31	do	10	204	Rice mill ½ mile below Pearl City	*d*. 10
31	do		205	Below rice mill ½ mile below Pearl City	1.47
Dec. 20	J. Colburn	8	204	Rice mill ½ mile below Pearl City	.81
20	do		205	Under clump of coconut trees ⅝ mile south of Pearl City.	1.31
20	Waterhouse	6	206	On peninsula below Pearl City	*e*. 15
19	Sing Chong	10	208	150 feet west of Waiawa stream and above railroad near Pearl City.	(*f*)
21	Plantation	10		Edge of cane field ½ mile east of Waipahu mill.	*g*. 14
21	Pump	8	231	½ mile east of Waipahu mill	*h*. 77
21	Well		232	¼ mile back of slaughterhouse, Waipahu	*i*. 20

a Refers to map made under the direction of Marston Campbell, Superintendent of Public Works.
b Pressure 22.15 feet.
c Valve not full open.
d Capacity about 3 second-feet; pressure 11.04 feet.
e Estimated. Well without valve, poorly capped. Water brackish.
f No place for measurement; water not used, but allowed to flow to Waiawa stream.
g Valve broken, water brackish.
h Flowing water for rice; slightly brackish, plantation pump attached.
i Estimated.

Miscellaneous measurements of wells around Pearl Harbor in 1911—Continued.

Date.	Well.	Size (inches).	No.	Locality.	Discharge.
					Sec.-ft.
Dec. 21	Cable Brown 4	10	233	Slaughterhouse, Waipahu	[a] 0.30
21	Cable Brown 5	12	234	Southeast Waipahu mill	1.41
21	Cable Brown 6	12	235	East side of road below Waipahu mill	3.19
22	Ay Yin 1	10	227	Southeast of Waipahu railroad station	[b] .05
22	Ay Yin 2	10	228	do	[c] .31
22	Ay Yin 3	10(?)	229	do	[d] .78
22	Wong Sa	12	273	¼ mile west of Waipahu railroad station and 100 feet mauka of railroad.	2.94
27	Magoon	10	272	Opposite red-roofed church west of Waipahu.	.67
27	Robinson			Hoaeae	.75
26	Honouliuli		279	200 feet east of windmill west of Honouliuli.	3.53
26	Windmill	8	280	½ mile west of Honouliuli railroad station	.79
26	Sing Chong		282	½ mile east of pumping station at Honouliuli.	2.76
26	Honouliuli	10	1½	½ mile back of Sing Chong well	[e] 2.80
26	do	10	28281	Northwest Honouliuli near pumping station.	[f] 1.23
June 14	Well	10(?)		Old Korean camp, Waialua	.84
14	Flume			Below pump 9, Waialua	[g] 1.7
14	Carter	12(?)		Near Hauula	1.41

[a] Estimated; no place for measurement; valve stuck.
[b] Estimated; well capped; water slightly brackish.
[c] Well without valve; plugged when not used for irrigating cane.
[d] Water used for irrigating cane.
[e] Estimated; no place to measure.
[f] Without valves; flows into stream when not used for flooding rice.
[g] Float measurement.

WELL SECTIONS.

Section of well No. 4, Beretania Street pumping station.

	Thickness.	Depth.
	Feet.	*Feet.*
Black sand	10	10
Bowlders	10	20
Punchbowl rock (red)	10	30
Bowlders	5	35
Punchbowl rock (red)	40	75
Coral	135	210
Clay	160	370
Coral (dark)	35	405
Clay and gravel	10	415
Clay and coral	45	460
Sand and gravel	10	470
Blue rock	40	510
Red water rock	30	540
Blue rock	40	580
Red rock	10	590
Blue rock	17.5	607.5

NOTE.—Well was sunk in March, 1910; 12-inch casing extends to a depth of 487 feet.

Section of T. R. Foster's well near Nuuanu and School Streets, Nuuanu.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	4	4
Black sand	4	8
Bowlders	6	14
Lava	40	54
Clay	16	70
Bowlders	12	82
Clay	20	102
Bowlders	8	110
Clay	300	410
Coral	40	450
Clay and gravel	110	560
Dark clay	40	600
Clay and bowlders	140	740
Lava or bedrock	27	767

Section of the King's well No. 2, at Kalihi.

[Waikiki of Wilcox's.]

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	4	4
Clay and bowlders	6	10
Coral	2	12
Lava	26	38
Clay	150	188
Coral	20	208
Clay	120	328
Lava	4	332
Clay	50	382
Lava or bedrock	218	600

Section of Honolulu plantation well No. 5 in field No. 16, at new Puuloa Camp, Aiea.

	Thickness.	Depth.
	Feet.	*Feet.*
Coral	245	245
Brown clay	45	290
Coral	30	320
Clay	10	330
Coral	35	365
Clay	20	385
Coral	55	440
Clay	55	495
Coral	20	515
Clay	35	550
White clay	65	615
Clay	80	695
Gray rock	10	705
Blue clay	25	730
Brown lava	27	757
Clay	10	767
Red lava	30	797
Hard blue lava	3	800

NOTE.—Casing extends to a depth of 520 feet.

Section of Laie well in Koolau.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	4	4
Coral	4	8
Clay	20	28
Bowlders	4	32
Clay	12	44
Bowlders	6	50
Clay	96	146
Lava or bedrock	154	300

SUMMARIES OF PUMPED WATER.

WATER PUMPED BY HONOLULU PLANTATION CO. AT AIEA, OAHU.

The following summary has been compiled by the Geological Survey from records furnished by the Honolulu Plantation Co. The measurements were obtained by means of pump displacement.

Monthly summary of water pumped by the Honolulu Plantation Co. at Aiea, Oahu, for 1911.

Month.	Quantity pumped daily.						Total quantity pumped.	
	Million gallons.			Second-feet.			Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.		
January	11.7	1.4	7.3	18	2.2	11	226	694
February	39.0	1.4	10.5	60	2.2	16	293	900
March	36.9	3.5	13.3	57	5.4	21	411	1,260
April	50.2	18.3	39.5	78	28	61	1,180	3,620
May	68.6	28.0	53.3	106	43	82	1,650	5,060
June	71.3	47.5	61.4	110	74	95	1,840	5,650
July	74.1	15.6	64.1	115	24	99	1,990	6,110
August	74.8	51.8	70.1	116	80	108	2,170	6,660
September	73.9	30.1	59.6	114	47	92	1,790	5,500
October	73.6	16.9	65.3	114	26	101	2,020	6,200
November	72.3	16.7	66.0	112	26	102	1,980	6,080
December	66.2	1.3	29.4	102	2.0	46	912	2,800
The year	74.8	1.3	45.0	116	2.0	69.5	16,500	50,500

WATER PUMPED BY OAHU SUGAR CO. AT WAIPAHU, OAHU.

The following summary has been compiled by the Geological Survey from records furnished by the Oahu Sugar Co. The figures include only the water raised by eight steam pumps, the average head being 420 feet. Other pumps on which no record is kept are estimated at about 10 million gallons daily. The maximum pumping capacity of the plant is 82 million gallons daily. There are 37 storage reservoirs. The measurements were obtained by means of pump displacement.

Monthly summary of water pumped by Oahu Sugar Co. at Waipahu, Oahu, for 1910–11.

[For eight steam pumps only.]

Month.	Million gallons.	Acre-feet.
1910.		
January	295	905
February	1,270	3,900
March	1,960	6,020
April	1,840	5,650
May	1,980	6,080
June	1,840	5,650
July	1,940	5,960
August	1,980	6,080
September	1,220	3,850
October	1,970	6,040
November	1,430	4,390
December	1,770	5,440
The year	19,500	59,900
1911.		
January	199	611
February	470	1,440
March	546	1,680
April	1,250	3,840
May	1,960	6,020
June	1,960	6,020
July	1,940	5,960
August	2,030	6,230
September	1,950	5,990
October	2,010	6,170
November	1,900	5,840
December	1,850	5,680
The year	18,100	55,500

WATER PUMPED BY EWA PLANTATION CO. AT EWA MILL, OAHU.

The following summary has been compiled by the Geological Survey from records furnished by the Ewa Plantation Co.

The measurements were obtained by means of pump displacement.

Monthly summary of water pumped by Ewa Plantation Co. at Ewa Mill, Oahu, for 1910–11.

Month.	Quantity pumped daily.						Total quantity pumped.	
	Million gallons.			Second-feet.			Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.		
1910.								
January	75.9	1.0	34.0	117	1.5	53	1,060	3,250
February	98.7	51.7	67.1	153	80	104	1,880	5,770
March	83.1	58.3	71.4	129	90	110	2,210	6,780
April	82.3	63.0	75.8	127	98	117	2,270	6,970
May	83.2	71.4	78.8	129	110	122	2,440	7,490
June	83.3	35.4	75.5	129	55	117	2,260	7,980
July	82.3	35.2	74.1	127	54	115	2,300	7,060
August	83.3	68.9	79.5	129	107	123	2,460	7,550
September	81.6	6.3	46.9	126	9.8	73	1,410	4,330
October	81.6	76.2	80.1	126	118	124	2,490	7,640
November	83.4	6.0	53.0	129	9.3	82	1,590	4,880
December	80.6	6.0	63.5	125	9.3	98	1,970	6,040
The year	98.7	1.0	66.6	153	1.5	103	24,300	75,700
1911.								
January	47.0	1.0	7.1	73	1.5	11	219	674
February	64.0	1.0	27.4	99	1.5	42	767	2,360
March	66.5	5.8	45.2	103	9.0	70	1,400	4,300
April	76.4	37.8	59.9	118	58	93	1,800	5,530
May	80.1	60.9	73.0	124	94	113	2,260	6,940
June	82.9	30.5	74.3	128	47	115	2,230	6,840
July	84.8	43.3	79.9	131	67	124	2,480	7,620
August	84.8	79.3	83.3	131	123	129	2,580	7,920
September	86.8	35.4	80.5	134	55	125	2,420	7,430
October	84.2	10.8	74.4	130	17	115	2,310	7,090
November	84.0	5.5	74.1	130	8.5	115	2,220	6,820
December	91.1	1.5	60.6	141	2.3	94	1,880	5,770
The year	91.1	1.0	61.6	141	1.5	95.5	22,600	69,300

WATER PUMPED BY WAIALUA AGRICULTURAL CO.

The following summary has been compiled from the daily pump reports of the Waialua Agricultural Co., showing the amount pumped by each of the 13 pumps as measured by displacement. The compilation has not been checked and therefore may be slightly in error.

Monthly summary of water pumped by Waialua Agricultural Co., Waialua, Oahu, for 1910–11.

Month.	Quantity pumped daily.						Total quantity pumped.	
	Million gallons.			Second-feet.			Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.		
1910.								
January			0.34			0.53	10.7	32.8
February			13.9			21.5	389	1,190
March			30.1			46.6	933	2,860
April			31.2			48.4	937	2,880
May			39.2			60.8	1,220	3,740
June			26.6			41.2	798	2,450
July			45.7			70.7	1,420	4,350
August			46.5			72.0	1,440	4,430
September			46.5			72.0	1,390	4,280
October			32.9			51.0	1,020	3,140
November			7.9			12.1	236	724
December			8.6			13.3	268	823
The year			27.5			42.7	10,100.	30,900
1911.								
January	8.9	.40	.93	14	.62	1.4	28.7	88.2
February	12.2	.21	2.8	19	.33	4.3	77.2	2,370
March	2.7	.20	.78	4.2	.31	1.2	24.1	74
April	38.1	.21	21.4	59	.33	33	642	1,970
May	45.0	28.0	38.8	70	43	60	1,200	3,690
June	46.0	29.0	42.1	71	45	65	1,260	3,870
July	62.0	10	49.1	96	16	76	1,520	4,670
August	62.0	40	52.6	96	62	81	1,630	5,010
September	62.0	8.3	46.2	96	13	71	1,390	4,270
October	56.0	8.7	43.1	87	13	67	1,340	4,110
November	46.0	1.1	29.5	71	1.7	46	886	272
December	35.0	.63	12.4	54	.98	19	384	1,180
The year	62.0	.20	28.3	96	.31	43.7	10,400	34,000.0

ISLAND OF MOLOKAI.

GENERAL FEATURES.

The island of Molokai lies between Oahu on the northwest and Maui on the southeast. It is nearly 40 miles long, east and west, and 6 to 9 miles wide. It is the fifth in size, having an area of 261 square miles. Its population in 1910 was 1,791, about half of whom were at the Kalaupapa settlement, on the northern coast.

The north side of Molokai is very rugged, especially along the eastern half. It consists of vertical cliffs 1,000 to 4,000 feet in height, which are cut by alcove valleys inaccessible except from the sea. The largest of these valleys are Pelekunu and Wailau, which reach half way through the island. Waikolu and Halawa are other deep gulches on the north and east side of the island, respectively. The highest point on Molokai (elevation 4,958 feet) is at the south end of the ridge between Pelekunu and Wailau valleys. The scenery along the northeast side of Molokai is said to be the wildest in the group.

WATER RESOURCES.

Practically all the streams on the island are on the northeast side. There is considerable water in some of the streams, but it is in short, deep canyons at a comparatively low elevation. The water is used for irrigating taro in Pelekunu and Wailau valleys.

The Survey has made no recent investigations on Molokai. Several years ago, however, a detailed report [1] on the water resources of the island was made by Waldemar Lindgren.

ISLAND OF MAUI.

GENERAL FEATURES.

The Maui group consists of the islands of Maui, Molokai, Lanai, and Kahoolawe. They are situated about halfway between Oahu on the northwest and Hawaii to the southeast. Maui is nearest to Hawaii, being separated from it by Alenuihaha Channel, 26 miles in width. Pailolo Channel, 8 miles wide, separates Maui from Molokai on the northwest. On the west Maui is separated from Lanai by Auau Channel, width 7 miles, and from Kahoolawe by Alalakeiki Channel, width, 6 miles. The distance from Honolulu to Lahaina, the nearest landing on Maui, is 72 miles.

Maui has an area of 728 square miles and is the second largest island in the group. Its greatest length is about 47 miles from northwest to southeast. The greatest width across East Maui is about 25 miles, and the least width across the isthmus is 6 or 7 miles.

Maui is a doublet—that is, it originally consisted of two distinct islands which were later united. West Maui is elliptical in shape, the main axis lying in a northwest-southeast direction. Its length is about 16 miles and its width about 11 miles. Roughly, East Maui forms an isosceles triangle with a base about 25 miles long lying in a north and south position, and with legs about 30 miles long extending southeastward and northeastward to the apex at the east end of the island. (See Pl. XIV, at end of volume.)

West Maui is much the older of the two Maui mountains. It is about the same age as Kauai, West Oahu, and Kohala mountains. No trace of the original big crater that must have formed West Maui seems to exist. Erosion has produced some picturesque valleys and canyons that are probably unsurpassed anywhere else in the group. The most notable of these is Iao Valley (Pl. VIII, *A*), on the windward side, with its broad amphitheater at the head 4,000 feet below the summit of Puu Kukui overlooking it. Waihee, Olowalu, Waikapu, and Honokahau are other canyons that have

[1] Lindgren, Waldemar, Water resources of Molokai. Water-Supply Paper U. S. Geol. Survey No. 77, 1903.

eaten their way to the center of the mountain. From the summit, at an elevation of 5,790 feet, many sharp ridges that have been worn almost to knife edges radiate in nearly every direction, forming the upper watersheds for the various streams that originate there.

East Maui is one of the younger mountains of the group. Its crater, Haleakala, at the summit, 10,000 feet above sea level, is the largest extinct crater in the world, and is as well preserved as if its fires were extinguished but yesterday. The crater is 20 miles in circumference and 2,000 feet deep, and contains many cinder cones, some of which rise 700 feet above its floor. There are two great gaps in the rim of the crater, Koolau at the north and Kaupo at the southeast, through which later lava flows poured into the sea at Keanae and Kaupo, respectively. Although there seems to be no record of the date, it is probable that the last flow took place through the Kaupo Gap only a few hundred years ago.

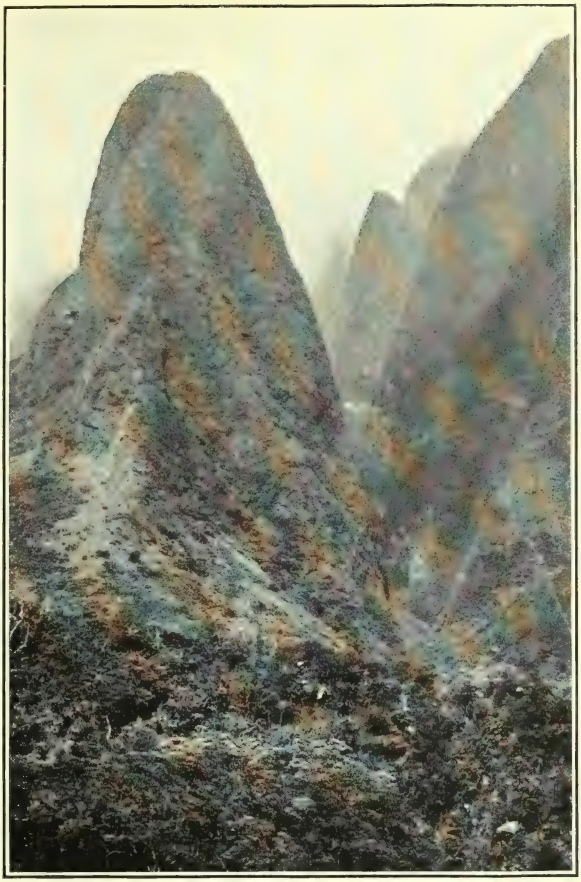
From the rim of the crater the slope is uniform in all directions, being steepest on the south. Erosion has not yet produced any of the knife-edge ridges and deep gorges that are so numerous on West Maui. Keanae Valley, on the northeastern slope, is the most prominent topographic feature, but it probably originated in a faulting rupture. Honomanu Gulch attains the proportions of a canyon for a short distance back from the sea, and next to Keanae is the most prominent of the East Maui gulches. Halehaku and Maliko are also long deep gulches on the northern slope of East Maui. The western and southern slopes are practically devoid of deep gulches. All the permanent streams are on the northeastern and southeastern slopes.

The shore line of Maui is fairly regular, there being no prominent points or capes. Cliffs exist on the northeastern coast, but they are are not very high. Maalaea, on the south side of the isthmus, is the largest bay. Hana is a small bay at the east end. The only harbor is Kahului, on the north side of the isthmus. Considerable coral exists along the west coast of West Maui and around Kahului Harbor on the north coast.

The rainfall varies greatly in different parts of Maui. On the west and south coasts it ranges from 20 to 30 inches annually and semiarid conditions prevail. On the northeast coast the rainfall is heavy, ranging from 100 to 300 inches or more on East Maui and from 150 to 200 or 300 inches in the mountains of West Maui.

The forest cover is confined almost entirely to the northeastern slope of East Maui and the higher mountains of West Maui. Very little vegetation exists on the western and southern slopes of West Maui except at the higher elevations.

Streams are numerous on the northeastern and southeastern slopes of East Maui. The largest and most constant streams, however, are on West Maui. Practically all the streams are used to irrigate



A. THE "NEEDLE," IAO VALLEY, MAUI.

B. A RECENT LAVA FLOW ON THE ISLAND OF HAWAII.

cane and taro. The cane belt is on the western and eastern sides of West Maui, the northwestern and southeastern sides of East Maui, and on the isthmus. Taro is grown in some of the valleys, and a small quantity of rice is also grown. Both taro and rice require irrigation.

Good roads exist on central Maui, along the western and southern coasts of West Maui, along the northern coast of East Maui as far as Kailua, and along the southeastern coast. Around the other parts of the island there is only a horse trail.

Wailuku is the principal town, and the county seat of Maui County. Lahaina, Kahului, Puunene, and Paia are important places.

The streams are described in clockwise order around West Maui, beginning with Waihee at the northeast, and in east-to-west order along the ditch systems of East Maui.

WEST MAUI.

WAIHEE STREAM BASIN.

GENERAL FEATURES.

Waihee basin lies on the northeast slope of West Maui south of Kahakuloa and north of Waiehu. It is about 6 miles long and 1 to 2 miles wide and comprises an area of approximately 10 square miles. The basin is deep and narrow, the upper part being closed in by almost vertical walls which separate it from Honokahau on the west and Iao at the south.

The almost incessant rainfall on the northeastern slopes of Eke and Puu Kukui gives a large run-off from a comparatively small drainage area. Numerous tributaries enter the main stream from both sides, and several tunnels have also been driven which develop additional water. The Waihee canal and Spreckels ditch divert water from the south side of the stream for irrigating cane, and several native auwais [1] take water at lower elevations for irrigating taro.

Gaging stations have been established on the main stream at the intake of Waihee canal, and on Waihee canal and Spreckels ditch.

WAIHEE STREAM AT DAM NEAR WAIHEE, MAUI.

A station was established on Waihee stream November 17, 1910. This station is at the dam which forms the intake of Waihee canal.

Records at this point show only the amount of water passing down the main stream after Waihee canal has been supplied.

A staff gage on the left wall is used for obtaining gage heights.

The discharge at this station, added to that of Waihee canal, gives the total flow of the stream, and also includes the water developed by two tunnels which were driven in 1909 jointly by the Wailuku Sugar Co. and the Hawaiian Commercial & Sugar Co.

[1] See glossary, p. 496.

Discharge measurements of Waihee Stream at dam near Waihee, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 29	Pierce and Schulz			0.35	[a] 29.9
1911.					
Jan. 27[b]	Martin and Pierce	43.8	28.7	.68	85.1
Mar. 28[c]	C. H. Pierce	36.4	42.6	.53	61.5
Aug. 22	J. B. Stewart			.27	[a] 18.0
Nov. 27	do			.00	[d] .05

[a] Discharge is the difference between the result of the measurement of stream above intake of Waihee Canal and of the canal below intake.
[b] Measurement by wading on crest of dam.
[c] Measurement above intake of Waihee Canal. The intake gates were closed during measurement and no water was being diverted by Waihee Canal.
[d] Discharge estimated.

Daily gage height, in feet, of Waihee Stream at dam near Waihee, Maui, for 1910–11.

[Joaquin Santos, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1		1.55	11		0.9	21	0.0	0.45
2		1.9	12		.8	22	.0	.7
3		2.0	13		.8	23	.05	.5
4		2.0	14		.7	24	.3	1.1
5		1.5	15		.45	25	.0	.8
6		1.9	16		.0	26	.0	.8
7		1.45	17	0.3	.0	27	.3	.75
8		1.0	18	.25	.0	28	.6	.4
9		1.0	19	.10	.25	29	1.3	.4
10		1.0	20	.15	.25	30	.95	.75
						31		.8

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.8	0.4	0.8	0.4	0.4	0.6	0.4	0.5	0.5	1.6	0.4	0.2
2	.8	.7	.5	.6	1.0	.8	.4	.6	.5	1.1	.4	.2
3	.35	.5	.3	.4	.4	.8	.4	.6	.5	.5	.4	.2
4	.5	1.1	.3	.4	.6	.8	.4	.7	.7	.5	.4	.2
5	.8	.5	.3	.4	.6	.8	.4	.8	.7	.5	.4	.2
6	1.3	1.05	.3	.3	.6	.8	.8	.8	.7	.5	.4	.2
7	1.25	.5	.3	.3	.7	.8	.8	.8	.6	.5	.4	.1
8	1.2	.6	.3	.4	.4	.8	.8	.9	.6	.5	.4	.1
9	1.2	1.25	.3	.3	3.1	1.0	.4	.8	.4	.5	.3	.0
10	1.3	1.55	.4	.3	1.8	1.0	.4	.7	.8	.5	.3	.0
11	1.3	.5	.3	.3	.8	1.0	.6	.8	.9	.4	.1	.0
12	1.3	.5	.3	.3	.8	1.2	.8	.8	.8	.4	.1	.05
13	.6	.5	.3	.3	.8	1.0	.8	.85	.8	.4	.0	.15
14	.6	.5	.3	.3	1.3	.8	1.0	.8	.7	.4	1.05	.10
15	.6	.5	.3	.3	1.0	.8	1.0	.8	.6	.4	.25	1.0
16	.8	.5	.3	.3	1.0	.8	.95	.9	.6	.4	.1	.8
17	1.5	.5	.8	.8	.8	.6	.6	.9	.8	.4	.3	.4
18	1.1	.5	.8	1.6	.8	.6	.5	1.15	.8	.65	.3	.55
19	1.1	.5	.55	1.7	.8	.4	.6	.8	.8	.4	.3	.5
20	1.1	.5	.7	1.9	.8	.8	.55	.8	1.5	.4	.3	.1
21	1.1	.5	.85	1.9	.8	.8	.6	.8	2.2	.4	.55	.0
22	1.1	.5	1.0	1.9	1.0	.8	.6	.6	1.4	.3	.8	.25
23	1.1	.5	.9	1.95	1.0	.6	.6	.4	4.4	.3	.8	.1
24	1.25	.2	.95	1.85	1.0	.8	.5	.4	.95	.3	.8	.1
25	1.2	1.35	.6	1.8	1.0	.8	.5	.4	1.0	.3	.7	.1
26	1.2	.5	.6	1.0	1.0	.4	.5	.4	1.1	.4	.8	.1
27	.7	.5	1.25	.9	1.0	.4	.5	.4	1.0	.4	.8	.1
28	1.3	.9	.3	.5	.9	.8	.5	.4	.8	.35	.85	.3
29	.8	.....	.8	.5	1.2	.8	.5	1.25	1.5	.3	.8	.3
30	.4	.....	.6	.5	1.5	.7	.5	.75	2.0	.4	.8	.6
31	.4	.....	.4	.....	1.3	.....	.5	.5	.....	.4	.....	.9

Daily discharge, in second-feet, of Waihee Stream at dam near Waihee, Maui, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			11		130	21	0.0	44
1		275	12		110	22	0.0	90
2		360	13		110	23	2.3	53
3		385	14		90	24	22	173
4		385	15		44	25	0.0	110
5		263	16		0.0	26	0.0	110
6		360	17	22	0.0	27	22	100
7		252	18	17	0.0	28	71	36
8		151	19	4.6	17	29	217	36
9		151	20	8.3	17	30	140	100
10		151				31		110

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	110	36	110	36	36	71	36	53	53	287	36	12
2	110	90	53	71	151	110	36	71	53	173	36	12
3	29	53	22	36	36	110	36	71	53	53	36	12
4	53	173	22	36	71	110	36	90	90	53	36	12
5	110	53	22	36	71	110	36	110	90	53	36	12
6	217	162	22	22	71	110	110	110	90	53	36	12
7	206	53	22	22	90	110	110	110	71	53	36	4.6
8	195	71	22	36	36	110	110	130	71	53	36	4.6
9	195	206	22	22	660	151	36	110	36	53	22	0.0
10	217	275	36	22	335	151	36	90	110	53	22	0.0
11	217	53	22	22	110	151	71	110	130	36	4.6	0.0
12	217	53	22	22	110	195	110	110	110	36	4.6	2.3
13	71	53	22	22	110	151	110	120	110	36	90	8.3
14	71	53	22	22	217	110	151	110	90	36	162	4.6
15	71	53	22	22	151	110	151	110	71	36	17	4.6
16	110	53	22	22	151	110	140	130	71	36	4.6	110
17	263	53	110	110	110	71	71	130	110	36	22	36
18	173	53	110	287	110	71	53	184	110	80	22	62
19	173	53	62	311	110	36	71	110	110	36	22	53
20	173	53	90	360	110	110	62	110	263	36	22	4.6
21	173	53	120	360	110	110	71	110	435	36	62	0.0
22	173	53	151	360	151	110	71	71	240	22	110	17
23	173	53	130	372	151	71	71	36	985	22	110	4.6
24	206	12	140	348	151	110	53	36	140	22	110	4.6
25	195	228	71	335	151	110	53	36	151	22	90	4.6
26	195	53	71	151	151	36	53	36	173	36	110	4.6
27	90	53	206	130	151	36	53	36	151	36	110	4.6
28	217	130	22	53	130	110	53	36	110	29	120	22
29	110	.....	110	53	195	110	53	206	263	22	110	22
30	36	.....	71	53	263	90	53	100	385	36	110	71
31	36	.....	36	.....	217	.....	53	53	.....	36	.....	130

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 100 second-feet.

Monthly discharge of Waihee Stream at dam near Waihee, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 17-30	217	0.0	37.6	1,040	B.
December	385	0.0	136	8,360	C.
1911.					
January	263	29	148	9,100	C.
February	275	12	83.5	4,640	B.
March	206	22	64	3,940	B.
April	372	22	125	7,440	C.
May	660	36	144	8,850	C.
June	195	36	105	6,250	B.
July	151	36	71.3	4,380	B.
August	206	36	94.4	5,800	B.
September	985	36	164	9,760	C.
October	287	22	51.8	3,190	B.
November	162	4.6	58.2	3,460	B.
December	130	0.0	21.0	1,290	B.
The year	985	0.0	94.6	68,100	

NOTE.—These estimates do not include the water diverted by Waihee Canal.

WAIHEE CANAL NEAR WAIHEE, MAUI.

Waihee canal diverts water from the south side of Waihee Stream at elevation 650 feet.

A station was established on this canal November 17, 1910, at a point about 2½ miles above Waihee and about 1 mile below the intake. It is 20 feet above the chute through which water is at certain times turned from Waihee canal to Spreckels ditch.

Gage heights are obtained from a staff gage, graduated in tenths of feet, which is placed on the *mauka* or right side of the ditch. The ditch at this place has a fairly smooth concrete lining and regular cross section. The discharge at this station added to that of the station on Waihee Stream at the dam gives the total discharge of Waihee Stream.

Discharge measurements of Waihee canal near Waihee, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 29	Pierce and Schulz	5.5	10.8	1.95	42.3
1911.					
Jan. 27	Martin and Pierce	5.5	11.8	2.13	52.1
Aug. 26	J. B. Stewart	5.35	14.4	2.15	56.4
Nov. 27	....do	5.6	14.6	2.15	57.7
Dec. 21	....do	5.7	14.3	2.10	56.6

NOTE.—An additional measurement made early in 1912 was used in determining the rating. Measurements made at various sections.

Daily gage height, in feet, of Waihee canal near Waihee, Maui, for 1910–11.

[Joaquin Santos, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.								
1		2.0	11		1.8	21	1.95	2.2
2		2.0	12		1.8	22	1.8	2.55
3		2.0	13		1.8	23	1.9	2.2
4		2.0	14		1.8	24	2.1	2.3
5		2.0	15		1.85	25	1.95	2.1
6		1.8	16		2.2	26	1.8	2.1
7		1.8	17	2.3	2.2	27	2.15	2.1
8		1.8	18	2.15	2.2	28	2.1	2.0
9		.0	19	1.9	2.2	29	2.2	2.0
10		.0	20	1.8	2.2	30	2.2	2.15
						31		2.2

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	2.2	1.6	1.8	1.75	1.9	2.2	2.2	2.2	2.0	2.6	2.6	2.2
2	2.2	1.9	1.8	.9	2.3	2.2	2.2	2.2	2.2	2.6	2.6	2.2
3	2.0	1.9	1.9	.0	2.1	2.2	2.4	2.1	2.2	2.6	2.6	2.2
4	2.2	2.1	1.9	.0	2.1	2.2	2.7	2.35	2.6	2.6	2.6	2.2
5	2.2	2.1	1.9	.0	2.1	2.2	2.6	2.2	2.6	2.6	2.6	2.1
6	2.2	2.1	2.0	1.5	2.1	2.4	2.7	2.2	2.6	2.6	2.6	2.1
7	2.2	2.1	2.0	1,5	2.1	2.4	2.3	2.2	2.6	2.6	2.6	2.15
8	2.2	2.1	2.1	1.5	2.1	2.2	2.6	2.2	2.6	2.6	2.6	2.2
9	2.2	2.1	2.1	1.5	2.3	2.4	2.6	2.55	2.6	2.6	2.4	2.2
10	2.2	1.95	2.1	1.5	2.5	2.3	2.6	2.2	2.6	2.6	2.3	2.2
11	2.2	1.8	2.1	1.5	2.5	2.3	2.8	2.2	2.8	2.6	2.2	2.2
12	2.2	1.8	2.1	1.6	2.5	2.2	2.8	2.2	2.8	2.6	2.2	2.2
13	2.2	2.2	2.1	1.6	2.5	2.2	2.6	2.65	2.6	2.6	2.6	2.2
14	2.2	2.2	2.1	1.6	2.5	2.2	2.8	2.6	2.6	2.6	2.5	2.2
15	2.2	2.2	2.1	1.6	2.5	2.2	2.8	2.6	2.6	2.6	2.2	2.2
16	2.2	2.2	2.1	1.6	2.5	2.2	2.8	2.6	2.4	2.6	2.2	2.2
17	2.0	2.2	2.1	2.55	2.5	2.2	2.5	2.6	2.5	2.6	2.2	2.2
18	2.0	2.2	2.1	3.0	2.5	2.2	2.0	2.7	2.7	2.6	2.2	2.2
19	2.2	2.2	2.15	2.3	2.5	2.4	2.1	2.2	2.6	2.6	2.2	2.2
20	1.6	2.2	2.2	2.2	2.9	2.4	2.1	2.4	2.6	2.6	2.2	2.05
21	1.6	2.2	2.2	2.2	2.8	2.2	2.2	2.2	2.6	2.5	2.3	2.1
22	1.6	2.2	.0	2.2	2.7	2.5	2.2	2.2	2.6	2.4	2.4	2.2
23	1.6	2.2	1.6	2.2	2.55	2.2	2.2	2.0	2.6	2.6	2.2	2.1
24	1.6	2.3	1.6	2.2	2.5	2.4	2.4	2.2	2.6	2.6	2.2	2.1
25	1.6	1.95	1.6	2.0	2.7	2.2	2.6	2.6	2.6	2.6	2.4	2.1
26	1.6	1.8	1.6	2.2	2.9	2.2	2.4	2.0	2.6	2.6	2.3	2.05
27	1.85	1.8	.8	2.0	2.8	2.3	2.2	2.0	2.6	2.6	2.3	2.1
28	2.1	1.8	1.7	2.1	2.8	2.2	2.2	2.2	2.6	2.6	2.2	2.2
29	2.1	.....	1.7	2.1	2.8	2.4	2.2	2.4	2.6	2.6	2.4	2.25
30	1.6	.....	1.7	2.1	2.9	2.2	2.2	2.1	2.6	2.6	2.4	2.3
31	1.6	.....	1.7	.....	2.7	.....	2.2	2.0	.....	2.6	.....	2.3

Daily discharge, in second-feet, of Waihee canal near Waihee, Maui, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.								
1		49	11		39	21	46	59
2		49	12		39	22	39	80
3		49	13		39	23	44	59
4		49	14		39	24	54	65
5		49	15		42	25	46	54
6		39	16		59	26	39	54
7		39	17	65	59	27	56	54
8		39	18	56	59	28	54	49
9		0	19	44	59	29	59	49
10		0	20	39	59	30	59	56
						31		59

Daily discharge, in second-feet, of Waihee canal near Waihee, Maui, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	59	31	39	35	44	59	59	59	49	83	83	59
2	59	44	39	11	65	59	59	59	59	83	83	59
3	49	44	44	0	54	59	71	54	59	83	83	59
4	59	54	44	0	54	59	90	68	83	83	83	59
5	59	54	44	0	54	59	83	59	83	83	83	54
6	59	54	49	27	54	71	90	59	83	83	83	54
7	59	54	49	27	54	71	65	59	83	83	83	56
8	59	54	54	27	54	59	83	59	83	83	83	59
9	59	54	54	27	65	71	83	80	83	83	71	59
10	59	46	54	27	77	65	83	59	83	83	65	59
11	59	39	54	27	77	65	97	59	97	83	59	59
12	59	39	54	31	77	59	97	59	97	83	59	59
13	59	59	54	31	77	59	83	86	83	83	83	59
14	59	59	54	31	77	59	97	83	83	83	77	59
15	59	59	54	31	77	59	97	83	83	83	59	59
16	59	59	54	31	77	59	97	83	71	83	59	59
17	49	59	54	80	77	59	97	83	77	83	59	59
18	49	59	54	111	77	59	49	90	90	83	59	59
19	59	59	56	65	77	71	54	59	83	83	59	59
20	31	59	59	59	104	71	54	71	83	83	59	52
21	31	59	59	59	97	59	59	59	83	77	65	54
22	31	59	0	59	90	77	59	59	83	71	71	59
23	31	59	31	59	80	59	59	49	83	83	59	54
24	31	65	31	59	77	71	71	59	83	83	59	54
25	31	46	31	49	90	59	83	83	83	83	71	54
26	31	39	31	59	104	59	71	49	83	83	65	52
27	42	39	9	49	97	65	59	49	83	83	65	54
28	54	39	35	54	97	59	59	59	83	83	59	59
29	54	.....	35	54	97	71	59	71	83	83	71	62
30	31	.....	35	54	104	59	59	54	83	83	71	65
31	31	.....	35	.....	90	.....	59	49	83	83	.....	65

NOTE.—Daily discharge computed from a rating curve that is fairly well defined between 40 and 60 second-feet.

Monthly discharge of Waihee canal near Waihee, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 17–30	65	39	50.0	1,380	B.
December	80	0	48.2	2,960	B.
1911.					
January	59	31	49.0	3,010	B.
February	65	31	51.6	2,870	B.
March	59	0	43.5	2,670	B.
April	111	0	41.1	2,450	C.
May	104	44	77.3	4,750	C.
June	77	59	63.0	3,750	B.
July	97	49	73.7	4,530	C.
August	90	49	64.9	3,990	B.
September	97	49	83.6	4,970	C.
October	83	71	82.4	5,070	C.
November	83	59	69.6	4,140	C.
December	65	52	57.8	3,550	B.
The year	111	0	63.2	45,800	

WAIHEE CANAL AT WEIR NEAR WAILUKU, MAUI.

A 14-foot sharp-crested weir without end contractions has been placed on Waihee canal about 1,000 feet below the inverted siphon crossing Iao Valley and about half a mile above Wailuku. This weir was built jointly by the Wailuku Sugar Co. and the Hawaiian Commercial & Sugar Co. The weir records for 1911 have been furnished by the Wailuku Sugar Co.

This weir measures the amount of water used by the Wailuku Sugar Co. on its Waikapu lands from 4 a. m. to 6 p. m. daily. From 6 p. m. to 4 a. m. daily the weir records the total flow of the canal which after passing over the weir is turned into Spreckels ditch for the use of the Hawaiian Commercial & Sugar Co.

Daily discharge, in second-feet, of Waihee canal at weir near Wailuku, Maui, for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	51	45	34	44	42	60	60	58	53	51	56	59
2	55	54	34	13	56	60	59	56	47	57	56	56
3	55	53	36	2.5	52	62	56	49	56	59	56	68
4	55	54	37	0	47	63	60	52	56	61	62	56
5	51	58	37	37	48	62	52	49	49	62	68	56
6	52	53	49	46	48	60	56	59	46	62	59	65
7	53	49	48	46	6	64	50	46	56	62	58	62
8	52	0	49	46	42	58	55	46	59	59	63	67
9	53	41	53	47	51	58	65	50	65	63	60	59
10	55	35	54	46	50	60	58	48	57	60	61	69
11	55	25	55	43	47	57	61	55	65	59	59	59
12	53	38	57	41	48	58	61	60	59	48	64	60
13	51	49	50	41	56	58	58	65	53	41	72	63
14	53	44	48	42	61	58	56	53	47	55	69	68
15	54	44	48	42	59	58	57	50	52	62	68	59
16	54	44	49	10	57	60	62	56	49	53	62	56
17	33	44	54	51	58	58	50	57	67	56	67	62
18	44	44	54	56	59	62	51	56	62	56	68	59
19	45	44	0	56	56	60	48	60	62	54	71	62
20	45	45	0	48	57	62	54	64	57	0	62	59
21	42	44	40	43	62	61	54	46	59	53	65	59
22	42	45	34	34	63	59	53	44	63	63	68	57
23	41	45	12	4	57	61	61	46	64	54	68	57
24	49	49	40	39	54	56	54	62	62	52	68	62
25	45	35	44	52	54	63	49	64	59	52	65	61
26	45	36	47	50	59	58	46	62	62	58	67	[a] 61
27	55	37	47	48	57	56	46	65	60	53	0	[a] 61
28	52	36	10	46	58	57	45	47	63	56	71	[a] 61
29	46	.....	44	44	60	57	46	53	61	66	67	[a] 61
30	44	.....	52	12	65	53	59	53	58	56	62	[a] 61
31	45	.....	45	.....	62	.....	47	54	.....	53	.....	[a] 61

[a] Record missing; discharge estimated.

NOTE.—Daily discharge computed by the Geological Survey from records of head on a 14-foot weir.

Monthly discharge of Waihee canal at weir near Wailuku, Maui, for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	55	33	49.2	3,030
February	58	0	42.5	2,360
March	57	0	40.7	2,500
April	56	0	37.7	2,240
May	65	6	53.3	3,280
June	64	53	59.3	3,530
July	65	45	54.5	3,350
August	65	44	54.4	3,340
September	67	46	57.6	3,430
October	66	0	54.7	3,360
November	72	0	62.1	3,700
December	69	56	60.8	3,740
The year	72	0	52.3	37,900

SPRECKELS DITCH NEAR WAIHEE, MAUI.

Spreckels ditch diverts water from the south side of Waihee Stream about 3 miles above Waihee at 225 feet lower elevation than the Waihee canal.

The station was established on this ditch November 17, 1910, at a point about 50 feet above the chute where water from Waihee canal enters the ditch.

A staff gage graduated in tenths of feet on the right, or mauka, side of the ditch is used for obtaining gage heights.

The records at this point show the amount of water diverted from Waihee Stream at the second intake downstream.

Discharge measurements of Spreckels ditch near Waihee, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 7	C. H. Pierce	6.3	3.6	0.15	2.0
Dec. 29	Pierce and Schulz	5.9	4.1	.90	24.3
1911.					
Jan. 27	Martin and Pierce	6.0	4.0	.80	22.6
Mar. 28	C. H. Pierce	6.0	6.6	1.50	58.0
Aug. 26	J. B. Stewart	11.2	8.2	1.00	31.0
Nov. 27	do	6.2	3.5	.19	2.16
Dec. 21	do	8.0	4.0	.25	3.61

NOTE.—Measurements made at various sections.

Daily gage height, in feet, of Spreckels ditch near Waihee, Maui, for 1910–11.

[Joaquin Santos, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1		1.4	11		1.2	21	0.4	0.65
2		1.4	12		1.2	22	.1	.8
3		1.4	13		1.2	23	.25	.9
4		1.4	14		1.2	24	.35	1.5
5		1.25	15		1.0	25	.1	1.8
6		1.2	16		.4	26	.1	1.8
7		1.2	17	1.6	.4	27	1.4	1.7
8		1.2	18	.4	.4	28	1.6	1.4
9		1.2	19	.1	.6	29	1.8	1.4
10		1.2	20	.1	.5	30	1.4	1.4
						31		.8

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.8	0.8	0.9	.8	0.9	1.3	0.8	1.0	1.7	1.8	1.6	0.2
2	.8	1.3	.9	.95	1.8	1.3	.8	1.0	1.7	1.8	1.6	.3
3	.65	1.3	.9	1.1	.7	1.4	1.0	1.0	1.7	1.8	1.6	.2
4	.8	1.6	.9	1.1	.7	1.4	1.2	1.3	1.8	1.8	1.5	.2
5	.8	1.8	.9	1.1	.7	1.4	1.2	.8	1.8	1.8	1.5	.4
6	.8	1.8	1.0	.7	.7	1.4	1.2	.8	1.8	1.9	1.4	.4
7	.8	1.8	1.0	.7	.7	1.4	1.0	.8	1.7	2.1	1.2	.6
8	.8	2.4	.8	.8	.7	1.4	1.2	.8	1.7	1.8	1.2	.6
9	.8	2.4	.8	.7	1.6	1.2	1.2	1.3	1.8	1.8	.6	.6
10	.8	1.8	.8	.7	1.6	1.2	1.4	1.7	1.8	1.7	.4	.7
11	.8	1.3	.8	.7	1.0	1.2	1.4	1.7	1.9	1.7	.25	.8
12	.8	1.3	.8	.8	1.4	1.4	1.4	1.8	2.0	1.6	.2	.6
13	.6	1.3	.8	.8	1.4	1.4	1.9	1.8	2.0	1.6	1.25	.8
14	.6	1.3	.6	.8	1.4	1.2	2.0	1.8	1.8	1.6	1.2	.8
15	.6	1.3	.5	.8	1.4	1.2	2.0	1.8	1.8	1.6	.6	.8
16	.6	1.3	.5	.8	1.4	1.2	1.95	1.8	1.8	1.6	.4	.8
17	.8	1.3	.5	1.3	1.4	1.4	.6	1.8	1.8	1.6	.4	.4
18	.8	1.3	.5	2.4	1.4	1.4	.6	1.85	1.85	1.7	.4	.4
19	.8	1.3	.7	1.8	1.3	1.2	.9	1.7	1.7	1.6	.4	.6
20	.8	1.3	.8	1.8	1.2	1.2	.9	1.75	3.0	1.6	.4	.3
21	.8	1.3	.8	1.8	1.0	1.2	.9	1.8	2.6	1.6	1.0	.35
22	.8	1.3	1.4	1.8	1.0	1.3	.9	1.7	2.4	1.6	1.6	.6
23	.8	1.3	1.4	1.8	1.0	1.2	.9	1.6	2.2	1.6	1.3	.4
24	.8	.5	1.4	1.8	.8	1.3	1.0	1.6	2.2	1.6	1.4	.3
25	.8	1.4	.6	1.7	.8	1.3	1.0	1.7	2.4	1.6	1.5	.05
26	.8	.9	.6	1.8	.9	1.3	.9	1.0	2.5	1.6	1.4	.1
27	.8	.9	1.65	1.2	.8	1.2	.9	1.0	2.4	1.6	1.4	.05
28	.8	.9	1.7	1.8	1.0	1.2	.8	.9	2.6	1.6	1.8	.0
29	.8	.....	.8	1.6	1.4	1.7	.8	1.6	2.7	1.6	1.8	.05
30	.8	.....	.6	1.4	1.6	1.2	.8	1.7	2.8	1.6	1.7	.3
31	.8	.....	.8	.....	1.4	.....	.8	1.7	.....	1.6	.....	.8

Daily discharge, in second-feet, of Spreckels ditch near Waihee, Maui, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1		53	11		41	21	7.2	16
2		53	12		41	22	1.0	22
3		53	13		41	23	3.6	26
4		53	14		41	24	5.8	59
5		44	15		31	25	1.0	77
6		41	16		7.2	26	1.0	77
7		41	17	65	7.2	27	53	71
8		41	18	7.2	7.2	28	65	53
9		41	19	1.0	14	29	77	53
10		41	20	1.0	10	30	53	53
						31		22

Daily discharge, in second-feet, of Spreckels ditch near Waihee, Maui, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	22	22	26	22	26	47	22	31	71	77	65	2.6
2	22	47	26	28	77	47	22	31	71	77	65	4.6
3	16	47	26	36	18	53	31	31	71	77	65	2.6
4	22	65	26	36	18	53	41	47	77	77	59	2.6
5	22	77	26	36	18	53	41	22	77	77	59	7.2
6	22	77	31	18	18	53	41	22	77	83	53	7.2
7	22	77	31	18	18	53	31	22	71	95	41	14
8	22	113	22	22	18	53	41	22	71	77	41	14
9	22	113	22	18	65	41	41	47	77	77	14	14
10	22	77	22	18	65	41	53	71	77	71	7.2	18
11	22	47	22	18	31	41	53	71	83	71	3.6	22
12	22	47	22	22	53	53	53	77	89	65	2.6	14
13	14	47	22	22	53	53	83	77	89	65	44	22
14	14	47	14	22	53	41	89	77	77	65	41	22
15	14	47	10	22	53	41	89	77	77	65	14	22
16	14	47	10	22	53	41	86	77	77	65	7.2	22
17	22	47	10	47	53	53	14	77	77	65	7.2	7.2
18	22	47	10	113	53	53	14	80	80	71	7.2	7.2
19	22	47	18	77	47	41	26	71	71	65	7.2	14
20	22	47	22	77	41	41	26	74	149	65	7.2	4.6
21	22	47	22	77	31	41	26	77	125	65	31	5.8
22	22	47	53	77	31	47	26	71	113	65	65	14
23	22	47	53	77	31	41	26	65	101	65	47	7.2
24	22	10	53	77	22	47	31	65	101	65	53	4.6
25	22	53	14	71	22	47	31	71	113	65	59	.5
26	22	26	14	77	26	47	26	31	119	65	53	1.0
27	22	26	68	41	22	41	26	31	113	65	53	.5
28	22	26	71	77	31	41	22	26	125	65	77	.0
29	22	.....	22	65	53	71	22	65	131	65	77	.5
30	22	.....	14	53	65	41	22	71	137	65	71	4.6
31	22	.....	22	.....	53	.....	22	71	.....	65	.....	22

NOTE.—Daily discharge computed from a rating curve that is well defined below 60 second-feet.

Monthly discharge of Spreckels ditch near Waihee, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 17–30	77	1.0	24.4	678	A.
December	77	7.2	39.7	2,440	A.
1911.					
January	22	14	20.8	1,280	A.
February	113	10	52.4	2,910	B.
March	71	10	26.6	1,640	A.
April	113	18	46.2	2,750	B.
May	77	18	39.3	2,420	A.
June	71	41	47.2	2,810	A.
July	89	14	38.0	2,340	A.
August	80	22	56.4	3,470	B.
September	149	71	92.9	5,530	B.
October	95	65	69.8	4,290	B.
November	77	2.6	39.9	2,370	B.
December	22	.0	9.82	604	A.
The year	149	0.0	44.7	32,400	

SPRECKELS DITCH AT WAIALE WEIR, NEAR WAILUKU, MAUI.

A 16-foot Cippoletti weir has been placed on this ditch just above the point where it empties into the Hawaiian Commercial & Sugar Co.'s reservoir.

The water in this ditch is used by the Wailuku Sugar Co. and the Hawaiian Commercial & Sugar Co. in equal amounts, exclusive of kuleana [1] water. From 6 p. m. to 4 a. m. daily this weir measures all the water received by the Hawaiian Commercial & Sugar Co. from West Maui, including all of Spreckles ditch and Waihee canal which joins it a few hundred feet above. In addition to the water in Waihee canal and Spreckels ditch, which comes from Waihee Stream, the water received from South Waiehu Stream and from a small flume and development tunnel from Iao Stream passes over this weir. The records for 1910–11 have been furnished by the Hawaiian Commercial & Sugar Co.

Mean daily discharge, in second-feet, of Spreckels ditch at Waiale weir, near Wailuku, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	30	42	33	47	30	55	22	27	28	50	20	49
2	36	29	40	33	49	69	23	25	28	82	22	44
3	30	31	67	46	35	45	25	34	45	68	22	36
4	28	30	60	31	47	40	63	76	50	57	23	37
5	25	30	64	26	43	57	34	59	26	42	22	44
6	17	28	50	25	56	25	32	60	31	42	23	37
7	10	18	42	41	75	39	35	48	28	42	30	27
8	13	23	37	70	38	37	23	33	23	46	24	27
9	23	24	33	41	48	37	20	47	21	45	19	42
10	20	26	33	45	44	33	20	37	22	27	31	38
11	26	30	32	31	35	32	22	35	22	26	30	39
12	35	29	36	27	31	29	36	42	22	26	19	44
13	24	20	35	26	28	42	24	74	22	23	20	50
14	27	17	35	24	27	24	27	73	23	21	20	44
15	18	27	36	25	33	41	77	37	22	21	21	40
16	20	3	36	25	34	25	65	30	27	20	23	33
17	15	30	35	62	31	27	73	26	33	20	48	35
18	22	28	36	45	34	43	41	27	25	21	27	32
19	32	22	57	42	38	24	43	26	25	21	22	28
20	29	28	70	48	40	30	29	72	24	23	21	29
21	28	22	57	38	25	40	20	81	25	24	24	27
22	24	39	45	31	26	34	21	52	35	27	21	41
23	30	22	58	42	28	42	22	51	36	25	31	28
24	21	30	54	78	27	22	21	50	59	24	43	48
25	20	28	55	43	24	22	23	62	32	22	24	58
26	20	30	79	51	22	22	39	45	32	22	25	57
27	25	34	61	42	23	26	38	45	28	21	40	50
28	18	34	55	38	24	20	28	34	38	23	52	36
29	26	.....	50	36	23	30	26	31	53	22	81	37
30	26	.....	32	32	28	28	38	31	81	20	57	42
31	37	.....	36	.....	78	.....	41	30	.....	20	.....	33
1911.												
1	20	51	34	43	43	58	58	40	38	65	40	30
2	21	73	32	42	72	81	58	48	47	70	40	31
3	24	76	31	40	50	76	51	37	47	75	40	31
4	36	76	32	38	37	66	68	43	56	76	39	37
5	34	66	36	37	46	72	41	38	46	75	38	33
6	37	64	36	34	43	68	50	31	40	66	40	32
7	35	66	32	33	59	73	40	32	50	74	37	26
8	39	74	33	36	42	63	37	32	54	68	45	40
9	34	73	32	39	66	61	50	50	42	45	34	26
10	37	54	39	28	68	78	57	40	54	45	36	29
11	38	29	28	38	47	65	76	46	84	46	36	27
12	39	34	28	41	45	54	69	52	75	44	35	26
13	41	37	27	44	80	68	50	72	52	44	67	30
14	33	40	25	32	66	67	52	42	37	43	79	41
15	21	39	26	28	68	52	54	38	41	45	64	28
16	23	36	25	45	62	63	90	58	39	44	39	28
17	37	34	31	61	50	58	43	72	51	50	42	22
18	30	31	40	70	54	67	38	60	58	45	44	17
19	34	36	70	63	55	64	37	71	44	46	39	27
20	35	32	61	60	67	64	41	46	80	43	35	18

74323°—wsp 318—13——14

Mean daily discharge, in second-feet, of Spreckles ditch at Waiale weir, near Wailuku, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	36	29	54	68	83	70	35	33	65	45	55	20
22	37	28	46	36	84	60	34	31	72	46	57	19
23	30	30	41	51	74	52	38	32	85	47	64	17
24	34	46	44	28	60	52	49	46	87	45	63	19
25	36	38	53	72	41	76	30	60	62	45	39	22
26	37	36	46	69	47	58	32	75	72	47	34	21
27	41	44	39	70	52	50	32	42	71	43	39	25
28	44	40	44	64	56	66	29	36	78	38	92	15
29	41	.....	40	39	61	49	30	58	70	40	45	24
30	38	.....	57	57	70	40	31	74	70	40	32	33
31	52	.....	42	.....	67	.....	34	52	.....	40	.....	36

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records furnished by the Hawaiian Commerical & Sugar Co.

Monthly discharge of Spreckels ditch at Waiale weir, near Wailuku, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	37	10	24.4	1,500
February	42	17	28.0	1,560
March	79	32	46.7	2,870
April	78	24	39.7	2,360
May	78	22	36.3	2,230
June	69	20	34.7	2,060
July	77	20	33.9	2,080
August	81	25	45.2	2,780
September	81	21	32.2	1,920
October	82	20	31.4	1,930
November	81	19	29.5	1,760
December	58	27	39.1	2,400
The year	82	10	35.2	25,400
1911.				
January	52	20	34.6	2,130
February	76	28	46.9	2,600
March	70	25	38.8	2,390
April	72	28	46.9	2,790
May	84	37	58.5	3,600
June	81	40	63.0	3,750
July	90	29	46.3	2,850
August	75	31	48.0	2,950
September	87	37	58.9	3,500
October	76	38	51.1	3,140
November	92	32	46.3	2,750
December	41	15	26.3	1,650
The year	92	15	47.1	34,100

WAIEHU STREAM BASIN.

GENERAL FEATURES.

Waiehu basin lies on the eastern slope of West Maui, south of Waihee basin and north of Iao basin. It is a short basin wedged in between Waihee and Iao, being about 5 miles long and 1 to 2 miles wide. There are two principal branches of the main stream which are called North Waiehu and South Waiehu. Water is diverted from both branches for irrigation through several ditches at various levels.

Gaging stations have been established on North and South Waiehu streams, and on the upper North Waiehu ditch.

NORTH WAIEHU STREAM NEAR WAILUKU, MAUI.

A station was established on North Waiehu stream January 31, 1911, about 3½ miles west of Waiehu and about 1 mile above the crossing of Waihee canal.

A staff gage, graduated to tenths of a foot, is located on the left bank in a slightly inclined position, and is used for obtaining gage heights. The discharge at this point gives the total flow of the stream exclusive of the amount diverted through the upper North Waiehu ditch.

Discharge measurements of North Waiehu Stream near Wailuku, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 15	C. H. Pierce	5.3	2.8	0.45	2.22
Dec. 28	Pierce and Schulz	7.8	9.0	.55	3.89
1911.					
Jan. 30[a]	....do	7.8	9.7	2.00	8.9
Apr. 1	C. H. Pierce	4.2	2.1	1.14	2.47
Aug. 30	J. B. Stewart	4.1	3.0	1.33	3.96
Oct. 11	....do	2.0	.76	1.02	2.73
Nov. 28	....do	.....	.....	1.82	7.2
Dec. 21	....do	.....	.....	1.38	4.62

[a] Gage reset at different section and datum.

NOTE.—Measurements made at various sections.

Daily gage height, in feet, of North Waiehu Stream near Wailuku, Maui, for 1911.

[Honda, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.3	.....	0.6	0.8	0.9	1.4	1.25	1.2	1.4	1.1	1.15
2	.....	1.85	1.6	.7	1.5	1.5	1.25	1.3	1.5	1.2	1.1	1.15
3	.....	1.8	1.6	.7	.8	1.5	1.25	1.25	1.25	1.1	1.1	1.15
4	.....	1.8	1.6	.6	.8	1.2	1.25	1.5	1.35	1.1	1.1	1.15
5	.....	1.9	1.5	.6	.8	1.5	1.25	1.25	1.35	1.1	1.1	1.15
6	.....	2.0	1.4	.6	.8	.85	1.3	1.25	1.25	1.1	1.1	1.15
7	.....	1.85	1.4	.6	.8	1.25	1.3	1.25	1.3	1.35	1.1	1.15
8	.....	1.8	1.4	.6	.8	.8	1.3	1.25	1.35	1.1	1.1	1.15
9	.....	2.05	1.4	.6	1.6	.8	1.3	1.25	1.35	1.1	1.1	1.15
10	.....	2.35	1.4	.6	1.6	1.4	1.3	1.25	1.35	1.1	1.1	1.15
11	.....	1.55	1.4	.6	.9	1.1	1.8	1.25	1.4	1.1	1.1	1.15
12	.....	1.4	1.4	.6	.9	1.2	1.5	1.25	1.3	1.1	1.1	1.1
13	.....	1.4	1.4	.6	1.4	1.3	1.3	1.3	1.2	1.1	1.5	1.1
14	.....	1.4	1.4	.8	1.85	1.4	1.3	1.25	1.2	1.1	1.15	1.15
15	.....	1.4	1.4	.8	1.0	1.3	1.3	1.25	1.1	1.1	1.1	1.2
16	.....	1.4	1.4	.8	.9	1.65	1.4	1.25	1.1	1.1	1.1	1.1
17	.....	1.4	1.4	.8	.9	1.3	1.3	1.35	1.1	1.2	1.1	1.1
18	.....	1.4	1.4	.8	.8	1.25	1.25	1.2	1.4	1.1	1.1	1.15
19	.....	1.4	1.6	.8	.8	1.3	1.25	1.2	1.15	1.1	1.1	1.15
20	.....	1.5	1.45	.8	1.75	1.35	1.3	1.2	1.85	1.1	1.1	1.15
21	.....	1.4	1.5	.9	.9	1.4	1.25	1.15	1.8	1.15	1.25	1.25
22	.....	1.4	1.5	.8	.9	1.3	1.25	1.15	1.5	1.1	1.2	1.1
23	.....	1.4	1.4	1.9	.8	1.3	1.25	1.1	2.25	1.1	1.2	1.1
24	.....	2.45	1.5	.8	.7	1.3	1.25	1.2	1.3	1.1	1.15	1.15
25	.....	1.6	1.5	1.5	.7	1.4	1.25	1.1	1.1	1.15	1.15	1.15
26	.....	1.4	1.4	1.0	.8	1.3	1.3	1.4	1.65	1.15	1.15	1.1
27	.....	1.8	1.4	1.95	.8	1.3	1.3	1.15	1.1	1.1	1.2	1.1
28	.....	1.85	.6	.85	.8	1.25	1.25	1.15	1.45	1.1	1.6	1.15
29	.....	.....	.6	.8	2.15	1.25	1.25	2.05	1.45	1.1	1.15	1.15
30	.....	.....	1.05	.85	1.45	1.25	1.25	1.5	1.7	1.1	1.15	1.15
31	2.0	.....	.6	.....	1.1	.....	1.25	1.25	.....	1.1	.....	1.15

Daily discharge, in second-feet, of North Waiehu Stream near Wailuku, Maui, for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.0	a6.7	1.4	2.0	2.3	4.5	3.8	3.5	4.5	3.1	3.3
2	.....	7.6	5.8	1.7	5.1	5.1	3.8	4.0	5.1	3.5	3.1	3.3
3	.....	7.2	5.8	1.7	2.0	5.1	3.8	3.8	3.8	3.1	3.1	3.3
4	.....	7.2	5.8	1.4	2.0	3.5	3.8	5.1	4.2	3.1	3.1	3.3
5	.....	7.9	5.1	1.4	2.0	5.1	3.8	3.8	4.2	3.1	3.1	3.3
6	.....	8.7	4.5	1.4	2.0	2.2	4.0	3.8	3.8	3.1	3.1	3.3
7	.....	7.6	4.5	1.4	2.0	3.8	4.0	3.8	4.0	4.2	3.1	3.3
8	.....	7.2	4.5	1.4	2.0	2.0	4.0	3.8	4.2	3.1	3.1	3.3
9	.....	9.1	4.5	1.4	5.8	2.0	4.0	3.8	4.2	3.1	3.1	3.3
10	.....	12	4.5	1.4	5.8	4.5	4.0	3.8	4.2	3.1	3.1	3.3
11	.....	5.4	4.5	1.4	2.3	3.1	7.2	3.8	4.5	3.1	3.1	3.3
12	.....	4.5	4.5	1.4	2.3	3.5	5.1	3.8	4.0	3.1	3.1	3.1
13	.....	4.5	4.5	1.4	4.5	4.0	4.0	4.0	3.5	3.1	5.1	3.1
14	.....	4.5	4.5	2.0	7.6	4.5	4.0	3.8	3.5	3.1	3.3	3.3
15	.....	4.5	4.5	2.0	2.7	4.0	4.0	3.8	3.1	3.1	3.1	3.5
16	.....	4.5	4.5	2.0	2.3	6.2	4.5	3.8	3.1	3.1	3.1	3.1
17	.....	4.5	4.5	2.0	2.3	4.0	4.0	4.2	3.1	3.5	3.1	3.1
18	.....	4.5	4.5	2.0	2.0	3.8	3.8	3.5	4.5	3.1	3.1	3.3
19	.....	4.5	5.8	2.0	2.0	4.0	3.8	3.5	3.3	3.1	3.1	3.3
20	.....	5.1	4.8	2.0	6.8	4.2	4.0	3.5	7.6	3.1	3.1	3.3
21	.....	4.5	5.1	2.3	2.3	4.5	3.8	3.3	7.2	3.3	3.8	3.8
22	.....	4.5	5.1	2.0	2.3	4.0	3.8	3.3	5.1	3.1	3.5	3.1
23	.....	4.5	4.5	7.9	2.0	4.0	3.8	3.1	10	3.1	3.5	3.1
24	.....	12	5.1	2.0	1.7	4.0	3.8	3.5	4.0	3.1	3.3	3.3
25	.....	5.8	5.1	5.1	1.7	4.5	3.8	3.1	3.1	3.3	3.3	3.3
26	.....	4.5	4.5	2.7	2.0	4.0	4.0	4.5	6.2	3.3	3.3	3.1
27	.....	7.2	4.5	8.3	2.0	4.0	4.0	3.3	3.1	3.1	3.5	3.1
28	.....	7.6	1.4	2.2	2.0	4.0	3.8	3.3	4.8	3.1	5.8	3.3
29	.....	.....	1.4	2.0	9.8	3.8	3.8	9.1	4.8	3.1	3.3	3.3
30	.....	.....	2.9	2.2	4.8	3.8	3.8	5.1	6.5	3.1	3.3	3.3
31	8.7	.....	1.4	.....	3.1	.....	3.8	3.8	.....	3.1	.....	3.3

a Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve well defined between 2 and 10 second-feet.

Monthly discharge of North Waiehu Stream near Wailuku, Maui, for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January 31	.....	.....	8.70	17.3	.....
February	12	4.0	6.27	348	A.
March	6.7	1.4	4.49	276	A.
April	8.3	1.4	2.32	138	B.
May	9.8	1.7	3.20	197	A.
June	6.2	2.0	3.92	233	A.
July	7.2	3.8	4.07	250	A.
August	9.1	3.1	3.95	243	A.
September	10	3.1	4.54	270	A.
October	4.5	3.1	3.22	198	A.
November	5.8	3.1	3.36	200	A.
December	3.8	3.1	3.27	201	A.
The period a	12	1.4	3.87	2,570	

a For 335 days, Jan. 31 to Dec. 31.

NORTH WAIEHU DITCH NEAR WAILUKU, MAUI.

North Waiehu ditch diverts water from the north side of North Waiehu Stream about half a mile above the station on the stream. A gaging station was established on this ditch at a point opposite the station on the stream December 1, 1910.

A staff gage, graduated in tenths of feet, is fastened to the left side of a wooden flume and is used for obtaining gage heights. This station is directly above the station on North Waiehu Stream and so placed that results are not influenced by leakage from the ditch below the gage.

To obtain the total flow of North Waiehu Stream, add the discharge at this station to the discharge at the station on the stream.

Discharge measurements of North Waiehu ditch near Wailuku, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 15	C. H. Pierce	2.0	1.7	0.85	3.37
Dec. 28	Pierce and Schulz	2.0	1.7	.80	4.12
1911.					
Apr. 1	C. H. Pierce	2.0	1.8	.90	4.97
Aug. 30	J. B. Stewart	2.0	1.9	.86	4.23
Oct. 11	do	2.0	1.6	.81	3.22
Nov. 28	do	2.0	1.8	.90	4.13

NOTE.—Measurements made in flume at various sections.

Daily gage height, in feet, of North Waiehu ditch near Wailuku, Maui, in 1910–11.

[Honda, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	0.8	11		21	0.8
2	.75	12		22	.8
3	.75	13		23	.8
4	.8	14		24	.8
5	.4	15		25	.8
6		16	0.8	26	.8
7		17	.8	27	.8
8		18	.8	28	.8
9		19	.8	29	.8
10		20	.8	30	.35
				31	.35

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.35			0.9	0.7	0.6	0.7	0.7	0.8	0.7	0.85	0.85
2	.35			.9	.75	.6	.7	.7	.85	.75	.85	.85
3	.6			.9	.7	.6	.7	.7	.8	.75	.85	.85
4	.6	0.6		.9	.7	.6	.7	.75	.85	.75	.85	.85
5	.6	.6	0.5	.9	.7	.6	.7	.7	.85	.75	.85	.85
6	.65	.6	.5	.9	.7	.6	.7	.7	.85	.75	.85	.85
7	.65	.6	.5	.9	.7	.6	.7	.7	.85	.85	.85	.85
8	.65	.6	.5	.9	.7	.6	.7	.7	.85	.8	.85	.85
9	.6	.6	.5	.9	.75	.6	.7	.7	.85	.8	.85	.85
10	.6	.65	.5	.9	.8	.6	.7	.7	.85	.8	.85	.85
11	.65	.65	.5	.9	.8	.6	.8	.7	.9	.8	.85	.9
12	.6	.65	.5	.9	.8	.6	.8	.7	.85	.8	.85	.85
13	.6	.65	.5	.9	.75	.6	.7	.7	.8	.8	.85	.85
14	.6	.6	.5	.6	.75	.6	.7	.7	.8	.8	.85	.85
15	.6	.6	.5	.6	.7	.6	.7	.7	.8	.8	.85	.85
16	.6	.6	.5	.7	.7	.65	.7	.7	.8	.8	.85	.85
17	.7	.6	.5	.7	.7	.65	.7	.8	.8	.8	.85	.85
18		.6	.5	.7	.6	.65	.7	.8	.85	.8	.85	.85
19		.6	.55	.7	.6	.65	.7	.8	.8	.8	.85	.85
20		.6	.55	.7	.8	.7	.7	.8	.95	.8	.85	.8

Daily gage height, in feet, of North Waiehu ditch near Wailuku, Maui, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
21	.....	0.6	0.5	0.7	0.7	0.7	0.7	0.8	0.95	0.8	0.85	0.85
22	.....	.6	.5	.7	.65	.65	.7	.8	.9	.8	.85	.85
23	.....	.6	.5	.75	.6	.65	.7	.8	1.0	.8	.85	.85
24	.....	.7	.55	.7	.6	.65	.7	.8	.9	.75	.85	.85
25	.....	.65	.5	.7	.6	.7	.7	.8	.85	.8	.85	.85
26	.....	.6	.5	.7	.6	.65	.7	.85	.9	.8	.85	.85
27	.....	.3	.5	.75	.6	.65	.7	.8	.85	.8	.85	.85
28	.....	.....	.95	.75	.6	.65	.7	.8	.9	.8	.9	.85
29	.....	.....	.95	.7	.7	.7	.7	.9	.9	.8	.85	.85
30	.....	.....	.95	.7	.6	.7	.7	.9	.9	.8	.85	.85
31	.....	.....	.9	.....	.6	.....	.7	.8	.....	.8	.....	.85

Daily discharge, in second-feet, of North Waiehu ditch near Wailuku, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	3.1	11	.....	21	3.1
2	2.7	12	.....	22	3.1
3	2.7	13	.....	23	3.1
4	3.1	14	.....	24	3.1
5	.8	15	.....	25	3.1
6	.....	16	3.1	26	3.1
7	.....	17	3.1	27	3.1
8	.....	18	3.1	28	3.1
9	.....	19	3.1	29	3.1
10	.....	20	3.1	30	.6
				31	.6

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.6	.....	.....	4.1	2.3	1.7	2.3	2.3	3.1	2.3	3.6	3.6
2	.6	.....	.....	4.1	2.7	1.7	2.3	2.3	3.6	2.7	3.6	3.6
3	1.7	.....	.....	4.1	2.3	1.7	2.3	2.3	3.1	2.7	3.6	3.6
4	1.7	1.7	.....	4.1	2.3	1.7	2.3	2.7	3.6	2.7	3.6	3.6
5	1.7	1.7	1.2	4.1	2.3	1.7	2.3	2.3	3.6	2.7	3.6	3.6
6	2.0	1.7	1.2	4.1	2.3	1.7	2.3	2.3	3.6	2.7	3.6	3.6
7	2.0	1.7	1.2	4.1	2.3	1.7	2.3	2.3	3.6	3.6	3.6	3.6
8	2.0	1.7	1.2	4.1	2.3	1.7	2.3	2.3	3.6	3.1	3.6	3.6
9	1.7	1.7	1.2	4.1	2.7	1.7	2.3	2.3	3.6	3.1	3.6	3.6
10	1.7	2.0	1.2	4.1	3.1	1.7	2.3	2.3	3.6	3.1	3.6	3.6
11	2.0	2.0	1.2	4.1	3.1	1.7	3.1	2.3	4.1	3.1	3.6	4.1
12	1.7	2.0	1.2	4.1	3.1	1.7	3.1	2.3	3.6	3.1	3.6	3.6
13	1.7	2.0	1.2	4.1	2.7	1.7	2.3	2.3	3.1	3.1	3.6	3.6
14	1.7	1.7	1.2	1.7	2.7	1.7	2.3	2.3	3.1	3.1	3.6	3.6
15	1.7	1.7	1.2	1.7	2.3	1.7	2.3	2.3	3.1	3.1	3.6	3.6
16	1.7	1.7	1.2	2.3	2.3	2.0	2.3	2.3	3.1	3.1	3.6	3.6
17	2.3	1.7	1.2	2.3	2.3	2.0	2.3	3.1	3.1	3.1	3.6	3.6
18	.....	1.7	1.2	2.3	1.7	2.0	2.3	3.1	3.6	3.1	3.6	3.6
19	.....	1.7	1.4	2.3	1.7	2.0	2.3	3.1	3.1	3.1	3.6	3.6
20	.....	1.7	1.4	2.3	3.1	2.3	2.3	3.1	4.8	3.1	3.6	3.1
21	.....	1.7	1.2	2.3	2.3	2.3	2.3	3.1	4.8	3.1	3.6	3.6
22	.....	1.7	1.2	2.3	2.0	2.0	2.3	3.1	4.1	3.1	3.6	3.6
23	.....	1.7	1.2	2.7	1.7	2.0	2.3	3.1	5.4	3.1	3.6	3.6
24	.....	2.3	1.4	2.3	1.7	2.0	2.3	3.1	4.1	2.7	3.6	3.6
25	.....	2.0	1.2	2.3	1.7	2.3	2.3	3.1	3.6	3.1	3.6	3.6
26	.....	1.7	1.2	2.3	1.7	2.0	2.3	3.6	4.1	3.1	3.6	3.6
27	.....	.5	1.2	2.7	1.7	2.0	2.3	3.1	3.6	3.1	3.6	3.6
28	.....	.....	4.8	2.7	1.7	2.0	2.3	3.1	4.1	3.1	4.1	3.6
29	.....	.....	4.8	2.3	2.3	2.3	2.3	4.1	4.1	3.1	3.6	3.6
30	.....	.....	4.8	2.3	1.7	2.3	2.3	4.1	4.1	3.1	3.6	3.6
31	.....	.....	4.1	.....	1.7	.....	2.3	3.1	.....	3.1	.....	3.6

NOTE.—Daily discharge computed from a rating curve that is poorly defined. On days when no discharge is given the ditch was not carrying water.

Monthly discharge of North Waiehu ditch near Wailuku, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December [a]	3.1	0.6	2.71	113	C.
1911.					
January [b]	2.3	.6	1.68	57	D.
February [c]	2.3	.5	1.74	83	D.
March [d]	4.8	1.2	1.73	93	D.
April	4.1	1.7	3.08	183	C.
May	3.1	1.7	2.25	138	C.
June	2.3	1.7	1.90	113	C.
July	3.1	2.3	2.35	144	C
August	4.1	2.3	2.78	171	C.
September	5.4	3.1	3.72	221	C.
October	3.6	2.3	3.01	185	C.
November	4.1	3.6	3.62	215	C.
December	4.1	3.1	3.60	221	C.
The period [e]	5.4	.5	2.68	1,820	

[a] For 21 days, Dec. 1–5 and 16–31.
[b] For 17 days, Jan. 1–17.
[c] For 24 days, Feb. 4–27.
[d] For 27 days, Mar. 5–31.
[e] For 343 days.

SOUTH WAIEHU STREAM NEAR WAILUKU, MAUI.

A gaging station was established on South Waiehu Stream at the intake of the upper ditch about 3 miles northwest of Wailuku November 17, 1910.

A staff gage, graduated in tenths of feet, is fastened to the upstream face of the concrete head gate at the intake.

The discharge at this station gives the total flow of the stream.

Discharge measurements of South Waiehu Stream near Wailuku, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 15	C. H. Pierce	3	1.4	0.40	3.36
Dec. 28	Pierce and Schulz	3	1.6	0.55	5.5
1911.					
Jan. 3[a]	....do	3	1.5	[b] 1.05	4.35
Apr. 1	C. H. Pierce	3	1.5	1.20	6.8
Aug. 30	J. B. Stewart			1.37	7.7
Oct. 11	....do	3	1.8	1.03	5.8
Nov. 28[c]	....do	7	6.2	2.27	11.6

[a] New gage installed at different location and datum.
[b] Old gage height was 0.50.
[c] Measurement by wading in stream above ditch intake; all other measurements in wooden flume which carries total flow of stream except at high stages.

Daily gage height, in feet, of South Waiehu Stream near Wailuku, Maui, for 1910–11.

[T. Burlem, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1		1.0	11		0.9	21	0.4	0.5
2		.8	12		.8	22	.4	.5
3		1.0	13		.7	23	.4	.5
4		1.0	14		.65	24	.75	.55
5		1.0	15		.4	25	.4	.7
6		1.0	16		.4	26	.45	.7
7		1.0	17	0.65	.4	27	.45	.55
8		1.0	18	.45	.4	28	.7	.5
9		1.0	19	.4	.4	29	1.0	.7
10		.95	20	.4	.45	30	1.0	.8
						31		.75

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1		1.2	2.35	1.2	1.2	1.4	1.2	1.2	1.2	1.6	1.2	1.2
2		1.8	1.35	1.45	1.9	1.3	1.2	1.2	1.2	1.5	1.2	1.2
3	1.3	1.6	1.2	1.30	1.2	1.3	1.2	1.2	1.2	1.3	1.2	1.2
4	2.0	2.45	1.2	1.4	1.2	1.2	1.3	1.8	1.2	1.2	1.2	1.2
5	3.0	1.5	1.2	1.4	1.2	3.0	1.3	1.2	1.2	1.2	1.2	1.2
6	2.05	2.3	1.2	1.2	1.2	1.4	1.4	1.2	1.2	1.6	1.2	1.2
7	1.45	1.35	1.2	1.2	1.2	1.2	1.4	1.2	1.2	1.2	1.2	1.2
8	1.10	1.85	1.2	1.65	1.2	1.2	1.4	1.2	1.2	1.2	1.2	1.2
9	1.15	2.45	1.2	1.2	3.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2
10	1.25	2.95	1.2	1.2	2.9	1.2	1.4	1.2	1.7	1.2	1.2	1.2
11	1.4	1.45	1.2	1.2	1.6	1.2	1.7	1.2	1.9	1.2	1.2	1.2
12	1.0	1.3	1.2	1.2	1.8	1.4	2.6	1.2	1.4	1.2	1.2	1.2
13	1.0	1.3	1.2	1.2	1.95	1.4	1.3	1.2	1.4	1.2	1.75	1.2
14	0.9	1.2	1.2	1.2	3.0	1.2	1.2	1.2	1.4	1.2	1.9	1.2
15	1.0	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2
16	1.05	1.2	1.2	1.2	1.2	1.7	1.2	1.2	1.2	1.2	1.2	1.2
17	3.2	1.2	1.2	1.2	1.2	1.4	1.2	1.2	1.2	1.2	1.2	1.2
18	1.5	1.2	1.2	1.5	1.3	1.4	1.2	1.5	1.4	1.2	1.2	1.3
19	1.5	1.2	1.85	2.0	1.4	1.3	1.2	1.2	1.3	1.2	1.2	1.2
20	1.25	1.2	1.45	2.0	1.2	1.2	1.2	1.2	2.05	1.2	1.2	1.2
21	1.2	1.2	1.45	2.75	1.2	1.4	1.2	1.2	3.4	1.2	1.3	1.2
22	1.1	1.2	1.4	1.7	1.4	1.2	1.2	1.2	1.85	1.2	1.4	1.2
23	1.1	1.2	1.7	1.3	1.5	1.2	1.2	1.2	4.0	1.2	1.4	1.2
24	1.7	1.2	1.4	1.2	1.3	1.2	1.2	1.2	3.5	1.2	1.4	1.2
25	2.0	3.5	1.3	1.3	1.2	1.4	1.2	1.2	2.45	1.2	1.4	1.2
26	2.0	1.85	1.2	1.8	2.2	1.4	1.2	1.8	3.0	1.2	1.4	1.2
27	2.0	1.2	1.2	2.4	3.0	1.3	1.2	1.2	2.95	1.2	1.4	1.2
28	3.2	2.4	1.2	1.3	2.5	1.2	1.2	1.2	1.5	1.2	1.6	1.2
29	2.1	.....	2.7	1.2	3.75	1.2	1.2	2.5	1.45	1.2	2.0	1.2
30	1.35	.....	1.4	1.2	1.4	1.2	1.2	1.7	3.45	1.2	1.8	1.2
31	1.2	.....	1.4	.....	1.25	.....	1.2	1.2	.....	1.2	.....	1.2

Daily discharge, in second-feet, of South Waiehu Stream near Wailuku, Maui, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1		13	11		11	21	3.4	4.7
2		9.5	12		9.5	22	3.4	4.7
3		13	13		7.8	23	3.4	4.7
4		13	14		7.0	24	8.6	5.2
5		13	15		3.4	25	3.4	7.8
6		13	16		3.4	26	4.0	7.8
7		13	17	7.0	3.4	27	4.0	5.2
8		13	18	4.0	3.4	28	7.8	4.7
9		13	19	3.4	3.4	29	13	7.8
10		12	20	3.4	4.0	30	13	9.5
						31		8.6

Daily discharge, in second-feet, of South Waiehu Stream near Wailuku, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	a 8.1	6.7	27	6.7	6.7	8.0	6.7	6.7	6.7	10	6.7	6.7
2	a 7.7	12	7.6	8.5	14	7.3	6.7	6.7	6.7	9.0	6.7	6.7
3	7.3	10	6.7	7.3	6.7	7.3	6.7	6.7	6.7	7.3	6.7	6.7
4	16	32	6.7	8.0	6.7	6.7	7.3	12	6.7	6.7	6.7	6.7
5	60	9.0	6.7	8.0	6.7	60	7.3	6.7	6.7	6.7	6.7	6.7
6	18	25	6.7	6.7	6.7	8.0	8.0	6.7	6.7	10	6.7	6.7
7	8.5	7.6	6.7	6.7	6.7	6.7	8.0	6.7	6.7	6.7	6.7	6.7
8	6.2	13	6.7	10	6.7	6.7	8.0	6.7	6.7	6.7	6.7	6.7
9	6.4	32	6.7	6.7	120	6.7	6.7	6.7	6.7	6.7	6.7	6.7
10	7.0	57	6.7	6.7	54	6.7	8.0	6.7	11	6.7	6.7	6.7
11	8.0	8.5	6.7	6.7	10	6.7	11	6.7	14	6.7	6.7	6.7
12	5.7	7.3	6.7	6.7	12	8.0	39	6.7	8.0	6.7	6.7	6.7
13	5.7	7.3	6.7	6.7	15	8.0	7.3	6.7	8.0	6.7	12	6.7
14	5.3	6.7	6.7	6.7	60	6.7	6.7	6.7	8.0	6.7	14	6.7
15	5.7	6.7	6.7	6.7	7.3	6.7	6.7	6.7	6.7	6.7	6.7	6.7
16	6.0	6.7	6.7	6.7	6.7	11	6.7	6.7	6.7	6.7	6.7	6.7
17	74	6.7	6.7	6.7	6.7	8.0	6.7	6.7	6.7	6.7	6.7	6.7
18	9.0	6.7	6.7	9.0	7.3	8.0	6.7	9.0	8.0	6.7	6.7	6.3
19	9.0	6.7	13	16	8.0	7.3	6.7	6.7	7.3	6.7	6.7	6.7
20	7.0	6.7	8.5	16	6.7	6.7	6.7	6.7	18	6.7	6.7	6.7
21	6.7	6.7	8.5	46	6.7	8.0	6.7	6.7	89	6.7	7.3	6.7
22	6.2	6.7	8.0	11	8.0	6.7	6.7	6.7	13	6.7	8.0	6.7
23	6.2	6.7	11	7.3	9.0	6.7	6.7	6.7	135	6.7	8.0	6.7
24	11	6.7	8.0	6.7	7.3	6.7	6.7	6.7	97	6.7	8.0	6.7
25	16	97	7.3	7.3	6.7	8.0	6.7	6.7	32	6.7	8.0	6.7
26	16	13	6.7	12	22	8.0	6.7	12	60	6.7	8.0	6.7
27	16	6.7	6.7	29	60	7.3	6.7	6.7	57	6.7	8.0	6.7
28	74	29	6.7	7.3	34	6.7	6.7	6.7	9.0	6.7	10	6.7
29	19	.....	44	6.7	116	6.7	6.7	34	8.5	6.7	16	6.7
30	7.6	.....	8.0	6.7	8.0	6.7	6.7	11	93	6.7	12	6.7
31	6.7	.....	8.0	.....	7.0	.....	6.7	6.7	.....	6.7	.....	6.7

a Discharge interpolated.

NOTE.—Daily discharge computed from rating curves fairly well defined between 4 and 8 second-feet. Above 10 second-feet the discharge is obtained by taking sum of flow in ditch and flow over broad crested weir and is only approximate.

Monthly discharge of South Waiehu Stream near Wailuku, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 17–30	13	3.4	5.84	162	B.
December	13	3.4	8.15	501	B.
1911.					
January	74	5.3	15.0	922	C.
February	97	6.7	16.0	889	C.
March	44	6.7	9.23	568	C.
April	46	6.7	10.1	601	C.
May	120	6.7	21.3	1,310	D.
June	60	6.7	9.10	541	C.
July	39	6.7	8.11	499	C.
August	34	6.7	8.14	501	C.
September	135	6.7	25.2	1,500	D
October	10	6.7	7.01	431	B.
November	14	6.7	8.00	476	B.
December	7.3	6.7	6.72	413	B.
The year	135	5.3	11.9	8,650	

IAO STREAM BASIN.

GENERAL FEATURES.

Iao basin is situated on the eastern slope of West Maui, south of Waiehu basin and north of Waikapu basin. It is a deep basin with almost vertical walls which widen out toward the upper end to form a sort of amphitheater tableland lying about 4,000 feet below the summit of Puu Kukui, the highest point on West Maui. Iao Valley is the most striking topographic feature in West Maui, and is frequently described as the Yosemite of Maui. (See Pl. VIII, *A*.)

The basin is 7 or 8 miles long, about 2 miles wide, and has an area of approximately 15 square miles. The upper part is contiguous to Waihee basin on the north, Kahoma, Kauula, and Laniupoko on the west, and Olowalu on the south.

The main stream has several tributaries or branches. It derives water also from several development tunnels which have been driven in the upper part of the basin.

Water is diverted from Iao Stream through several ditches on each side at various levels.

Gaging stations have been established on the main stream above all diversions and on Maniania ditch, which is the largest diversion from the stream.

IAO STREAM NEAR WAILUKU, MAUI.

A gaging station was established on Iao Stream at a point 2.9 miles above Wailuku, May 7, 1910. The station is below the two main branches of the stream and above the intake of the highest ditch at an elevation of 810 feet.

A Friez weekly clock register is used to obtain gage heights, individual readings being made by a chain gage attached to the clock register house.

Measurements are made from a cable or by wading at low stages. Ordinarily the stream is 25 to 40 feet wide and the total range in stage is 6 or 7 feet.

The discharge at this point gives the total flow above all diversions.

Discharge measurements of Iao Stream near Wailuku, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 8	Martin and Pierce	.....	.....	4.25	[a] 72
21	C. H. Pierce	25	27.9	[b] 3.02	29.4
22	.....do	27	43.5	3.58	76
27	.....do	25.5	25.6	3.00	24.8
28	.....do	26.1	27.9	3.04	30.5
31	.....do	26	24.5	2.97	22.8
Nov. 16	.....do	25	23.3	2.91	21.2
17	.....do	34.5	94	4.40	183
26	.....do	26	27.5	3.09	30
28	.....do	35	94	4.40	189
29	.....do	36	126	5.30	429
Dec. 22	.....do	31.3	51	3.00	44.3
24	.....do	31.3	51	3.06	45
26	.....do	36	94	4.35	247
26	.....do	36	104	4.60	296
30	Pierce and Schulz	33.5	73	3.71	122
1911.					
Jan. 4	.....do	35.5	90	4.22	192
Mar. 26	C. H. Pierce	31.5	73	2.88	31.3
27	.....do	31.5	73	2.80	31.5
31	.....do	31.5	83	3.10	49.4
Apr. 12	.....do	18.5	61	2.85	30.5
Aug. 31	J. B. Stewart	32.5	89	3.50	89
Sept. 19	.....do	34	32	3.00	53
Oct. 9	.....do	33	39.8	3.10	58
Nov. 25	.....do	31.5	31.1	2.93	38.3

[a] Discharge is the difference between measurement of stream below Culvert Creek and flow of creek which was estimated at 2.5 second-feet.
[b] Weir removed Oct. 20, causing change of section.

NOTE.—Measurement of Nov. 17, 1910, and those from Nov. 28, 1910, to Aug. 31, 1911, made at regular section; all others by wading at various sections.

Daily gage height, in feet, of Iao Stream near Wailuku, Maui, for 1910–11.

[F. G. Duarte, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	.....	.....	.....	.....	.....	1.1	4.8	4.9	.....	4.6	2.95	5.0
2	.....	.....	.....	.....	.....	1.85	.....	4.85	.....	5.75	2.95	6.25
3	.....	.....	.....	.....	.....	.....	.....	5.55	5.0	5.2	2.95	4.45
4	.....	.....	.....	.....	.....	1.0	.....	5.95	4.9	4.9	2.95	3.95
5	.....	.....	.....	.....	.....	1.2	.....	5.6	4.6	4.75	2.95	4.35
6	.....	.....	.....	.....	.....	.85	.....	5.5	4.5	4.7	2.95	5.65
7	.....	.....	.....	.....	1.8	1.1	.....	4.5	4.45	4.85	3.0	4.7
8	.....	.....	.....	.....	1.25	1.05	.....	4.55	.....	4.7	2.95	3.9
9	.....	.....	.....	.....	1.5	.95	4.35	4.8	4.4	4.4	2.95	3.55
10	.....	.....	.....	.....	1.35	.85	4.3	4.55	4.3	4.2	3.35	3.4
11	.....	.....	.....	.....	1.2	1.1	4.4	4.55	3.95	4.1	3.1	3.25
12	.....	.....	.....	.....	1.0	.....	4.5	4.75	3.95	4.2	2.95	3.15
13	.....	.....	.....	.....	.9	.....	4.3	5.1	3.9	4.0	2.95	3.1
14	.....	.....	.....	.....	1.05	.....	4.45	4.95	3.9	3.95	2.9	3.0
15	.....	.....	.....	.....	.9	.....	.....	4.65	3.85	3.85	2.9	2.95
16	.....	.....	.....	.....	1.3	.75	5.45	4.5	3.9	3.8	3.1	2.95
17	.....	.....	.....	.....	1.05	1.2	5.2	4.4	3.9	3.8	3.7	2.9
18	.....	.....	.....	.....	1.15	.9	5.0	4.35	3.95	3.75	3.25	2.9
19	.....	.....	.....	.....	1.1	.75	5.0	4.4	3.9	3.75	3.2	2.95
20	.....	.....	.....	.....	.95	1.3	4.7	5.75	3.85	3.0	3.1	2.9
21	.....	.....	.....	.....	.9	1.3	.....	5.9	3.85	2.95	3.15	2.95
22	.....	.....	.....	.....	.85	1.15	.....	4.85	3.95	3.3	3.05	3.1
23	.....	.....	.....	.....	.85	4.95	.....	4.6	4.0	3.35	3.45	2.95
24	.....	.....	.....	.....	.8	4.85	.....	4.9	4.4	3.15	3.7	3.4
25	.....	.....	.....	.....	.75	4.8	4.45	5.3	4.3	3.1	3.15	3.25
26	.....	.....	.....	.....	.7	4.75	4.75	4.75	4.1	3.1	3.1	4.0
27	.....	.....	.....	.....	.7	4.65	4.6	4.75	.....	3.05	3.35	3.25
28	.....	.....	.....	.....	.7	4.6	4.45	4.55	4.05	3.1	3.7	2.9
29	.....	.....	.....	.....	.7	4.8	4.4	4.50	4.95	3.0	4.9	3.3
30	.....	.....	.....	.....	1.25	4.8	4.8	4.55	5.7	3.0	4.3	3.45
31	.....	.....	.....	.....	2.75	.....	5.1	.....	.....	2.95	.....	3.85

Daily gage height, in feet, of Iao Stream near Wailuku, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	3.45	3.8	3.9	3.0	3.35	3.35	3.5	3.3	3.35	3.9	2.75	2.9
2	3.25	4.6	3.6	3.0	3.8	3.9	3.35	3.3	3.4	3.55	2.75	2.8
3	3.2	4.55	3.4	3.1	3.45	4.3	3.4	3.15	3.3	3.5	2.75	2.8
4	3.9	3.6	3.0	2.9	3.3	4.2	3.5	3.3	3.5	3.45	2.75	2.8
5	4.4	3.9	2.9	2.9	3.35	4.45	3.3	3.2	3.25	3.35	2.8	2.8
6	3.8	4.0	2.9	2.9	3.3	3.9	3.6	3.1	3.2	3.4	2.8	2.9
7	3.4	4.1	2.9	2.85	3.15	4.3	3.3	3.1	3.6	3.7	2.8	2.95
8	3.2	4.6	2.9	2.85	3.25	3.9	3.45	3.15	3.55	3.25	2.9	3.2
9	3.15	5.0	2.9	2.80	4.0	3.9	3.55	3.35	3.3	3.1	2.8	2.9
10	3.5	5.6	2.9	2.8	4.05	4.1	3.35	3.2	3.6	3.05	2.8	2.85
11	3.95	4.6	2.9	2.85	3.55	3.6	3.3	3.3	4.7	3.0	2.8	2.8
12	3.8	4.1	2.9	2.9	3.6	3.9	3.35	3.4	3.9	2.95	2.8	2.8
13	3.7	3.9	2.9	2.8	3.5	3.9	3.25	3.7	3.5	2.95	3.4	2.85
14	3.25	3.7	2.9	2.8	4.1	3.8	3.45	3.3	3.35	2.9	3.8	2.85
15	3.15	3.65	2.9	2.75	4.1	3.55	3.35	3.3	3.35	2.9	3.2	3.3
16	3.15	3.6	2.95	3.1	3.8	3.75	3.5	3.8	3.3	2.9	3.0	2.95
17	3.75	3.6	2.95	3.6	3.45	3.6	3.25	4.0	3.45	3.0	3.2	3.0
18	3.5	3.55	2.95	3.95	3.4	3.65	3.2	3.8	3.7	2.9	3.0	3.2
19	3.7	3.55	3.25	3.9	3.3	3.55	3.15	4.1	3.25	2.9	3.0	3.3
20	3.65	3.55	2.95	3.8	3.25	3.7	3.35	3.4	3.9	2.9	3.0	2.95
21	3.5	3.55	2.95	4.3	3.8	3.8	3.2	3.2	3.9	2.9	3.2	2.9
22	3.3	3.55	2.95	3.9	4.45	3.5	3.15	3.15	4.0	.....	3.50	2.85
23	3.2	3.55	2.95	4.0	3.85	3.35	3.1	3.1	4.5	.....	3.25	2.8
24	4.05	4.05	3.0	4.0	3.5	3.3	3.1	3.7	4.0	.....	3.25	2.8
25	4.1	4.1	3.3	4.2	3.35	3.3	3.0	3.85	3.7	.....	3.0	2.75
26	4.0	4.3	2.9	4.3	3.45	3.3	3.0	3.7	4.2	.....	2.85	2.7
27	4.5	4.7	2.85	3.9	3.3	3.3	3.0	3.3	3.95	2.8	3.1	2.95
28	5.4	4.25	2.8	3.75	3.15	3.3	3.0	3.2	4.25	2.8	3.7	3.0
29	4.1	.....	2.8	3.4	3.5	3.15	3.0	4.2	3.95	2.75	3.05	3.0
30	3.75	.....	3.45	3.65	3.8	3.1	3.0	4.0	4.4	2.75	2.95	2.95
31	3.9	.....	3.15	.....	3.55	.....	3.0	3.5	.....	2.75	.....	2.85

Daily discharge, in second-feet, of Iao Stream near Wailuku, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	.....	.....	.....	.....	.....	47	80	93	a 120	128	24	337
2	.....	.....	.....	.....	.....	101	a 80	86	a 210	402	24	772
3	.....	.....	.....	.....	.....	a 70	a 70	202	210	257	24	196
4	.....	.....	.....	.....	.....	40	a 70	288	188	188	24	110
5	.....	.....	.....	.....	.....	53	a 60	212	128	157	24	176
6	.....	.....	.....	.....	.....	31	a 50	192	110	147	24	553
7	.....	.....	.....	.....	96	47	a 40	45	102	178	26	253
8	.....	.....	.....	.....	56	43	a 30	50	a 100	147	24	142
9	.....	.....	.....	.....	73	37	29	80	94	94	24	94
10	.....	.....	.....	.....	63	31	24	50	79	65	49	77
11	.....	.....	.....	.....	53	47	34	50	34	52	32	62
12	.....	.....	.....	.....	40	a 42	45	74	34	65	24	54
13	.....	.....	.....	.....	34	a 38	24	122	29	40	24	50
14	.....	.....	.....	.....	43	a 34	40	100	29	34	21	43
15	.....	.....	.....	.....	34	a 30	a 110	62	24	24	21	40
16	.....	.....	.....	.....	59	26	182	45	29	20	32	40
17	.....	.....	.....	.....	43	53	138	34	29	20	81	37
18	.....	.....	.....	.....	49	34	107	29	34	16	42	37
19	.....	.....	.....	.....	47	26	107	34	29	16	38	40
20	.....	.....	.....	.....	37	59	68	402	24	26	32	37
21	.....	.....	.....	.....	34	59	a 68	446	24	24	35	40
22	.....	.....	.....	.....	31	49	a 60	178	34	45	29	50
23	.....	.....	.....	.....	31	100	a 50	128	40	49	58	40
24	.....	.....	.....	.....	29	86	a 40	188	94	35	81	77
25	.....	.....	.....	.....	26	80	40	282	79	32	35	62
26	.....	.....	.....	.....	23	74	74	157	52	32	32	159
27	.....	.....	.....	.....	23	62	56	157	a 50	29	49	62
28	.....	.....	.....	.....	23	56	40	119	46	32	81	37
29	.....	.....	.....	.....	23	80	34	110	199	26	307	67
30	.....	.....	.....	.....	56	80	80	119	388	26	166	83
31	.....	.....	.....	.....	182	.....	122	a 120	.....	24	.....	134

a Discharge interpolated.

Daily discharge, in second-feet, of Iao Stream near Wailuku, Maui, for 1910–11—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	83	127	142	43	72	72	88	67	72	146	32	37
2	62	296	100	43	27	142	72	67	77	100	32	32
3	58	282	77	50	83	221	77	54	67	95	32	32
4	142	100	43	37	67	199	88	67	88	90	32	32
5	244	142	37	37	72	256	67	58	62	80	34	32
6	127	159	37	37	67	142	100	50	58	85	34	37
7	77	178	37	34	54	221	67	50	100	118	34	40
8	58	296	37	34	62	142	83	54	94	72	40	58
9	54	420	37	32	159	142	94	72	67	59	34	37
10	88	624	37	32	168	178	72	58	100	55	34	34
11	150	296	37	34	94	100	67	67	324	51	34	32
12	127	178	37	37	100	142	72	77	142	48	34	32
13	113	142	37	32	88	142	62	113	88	48	78	34
14	62	113	37	32	178	127	83	67	72	44	128	34
15	54	106	37	30	178	94	72	67	72	44	58	67
16	54	100	40	50	127	120	88	127	67	44	43	40
17	120	100	40	100	83	100	62	159	83	51	58	43
18	88	94	40	150	77	106	58	127	113	44	43	58
19	113	94	62	142	67	94	54	178	72	43	43	67
20	106	94	40	127	62	113	72	77	146	43	43	40
21	88	94	40	221	127	127	58	58	146	43	58	37
22	67	94	40	142	256	88	54	54	163	a 43	88	34
23	58	94	40	159	134	72	50	50	273	a 43	62	32
24	168	168	43	159	88	67	50	113	163	a 43	62	32
25	178	178	67	199	72	67	43	134	118	a 37	43	30
26	159	221	37	221	83	67	43	113	203	a 37	34	28
27	269	324	34	142	67	67	43	67	154	37	50	40
28	556	210	32	120	54	67	43	58	214	35	113	43
29	178	.....	32	77	88	54	43	199	154	32	46	43
30	120	.....	83	106	127	50	43	159	248	32	40	40
31	142	.....	54	.....	94	.....	43	88	.....	32	.....	34

a Discharge interpolated.

NOTE.—Daily discharge from May 7 to June 22, 1910, obtained by using gage heights as head on 12-foot weir. From June 23 to Aug. 19, 1910, daily discharge is based on three estimates, and from Aug. 20 to Oct. 19, 1910, on two miscellaneous measurements and two estimates. (See list of miscellaneous measurements.) Beginning Oct. 20 daily discharge is computed from rating curves applicable as follows: Oct. 20 to Dec. 7, 1910, well defined between 25 and 450 second-feet; Dec. 8, 1910, to Sept. 18, 1911, and from Nov. 25, 1911, to Dec. 31, 1911, well defined between 25 and 300 second-feet; Sept. 19, 1911, to Oct. 9, 1911, fairly well defined between 50 and 300 second-feet; Oct. 9 to Nov. 24, 1911, indirect method for shifting channels.

Monthly discharge of Iao Stream near Wailuku, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
May 7–31	182	23	48.3	2,400	D.
June	101	26	53.8	3,200	D.
July	138	24	66.2	4,070	D.
August	446	29	137	8,420	D.
September	388	24	88.1	5,240	D.
October	402	16	78.4	4,820	B.
November	307	21	49.6	2,950	A.
December	772	37	128	7,870	A.
The period	.....	.....	.....	39,000	
1911.					
January	556	54	128	7,870	A.
February	624	94	190	10,600	A.
March	142	32	48.2	2,960	A.
April	221	30	88.6	5,270	A.
May	256	54	102	6,270	B.
June	256	50	119	7,080	B.
July	100	43	64.9	3,990	B.
August	199	50	88.7	5,450	B.
September	324	58	127	7,560	B.
October	146	32	57.2	3,520	B.
November	128	32	49.9	2,970	B.
December	67	28	39.1	2,400	A.
The year	624	28	91.1	65,800	

MANIANIA DITCH NEAR WAILUKU, MAUI.

Maniania ditch diverts water from the north side of Iao Stream at a point about 2½ miles above Wailuku and one-fourth mile below the gaging station on the stream. About a mile below the intake this ditch divides, one branch crossing the valley in a pressure pipe for use on the south side of the valley, the other branch remaining on the north side.

A gaging station was established in the flume below the road crossing and above the point where the ditch divides, November 14, 1910.

A staff gage, graduated in tenths of feet, is fastened to the left side of the flume.

The discharge at this point shows the amount of water diverted by the ditch exclusive of kuleana water returned to the stream above the station during certain hours of the day.

This ditch is the principal diversion from Iao Stream, although several smaller ditches take out water at lower elevations.

Discharge measurements of Maniania ditch near Wailuku, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 21	C. H. Pierce	3.25	6.06	1.80	26.3
21	do	3.25	5.42	1.60	19.0
31	do	3.25	5.64	1.75	20.9
31	do	3.25	5.20	1.60	15.9
Nov. 14	do	3.25	5.53	1.70	19.5
14	do	3.25	5.03	1.53	14.2
26	do	3.30	5.78	1.68	21.1
Dec. 26	do	3.25	5.20	1.60	19.1
1911.					
Mar. 27	do	3.20	5.18	1.55	21.6
Aug. 31	J. B. Stewart	3.30	6.27	1.90	32.2

NOTE.—Measurements made in flume below gage.

Daily gage height, in feet, of Maniania ditch near Wailuku, Maui, for 1910–11.

[Frank Bestana, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1		1.55	11		1.30	21	1.74	1.62
2		1.55	12		1.35	22	1.62	1.75
3		1.55	13		1.35	23	1.72	1.68
4		1.55	14	1.53	1.70	24	1.85	1.75
5		1.55	15	1.70	1.72	25	1.75	1.52
6		1.40	16	1.60	1.68	26	1.71	1.55
7		1.25	17	1.90	1.68	27	1.66	1.75
8		1.00	18	1.86	1.40	28	1.88	1.75
9		1.50	19	1.80	1.70	29	1.60	1.75
10		1.40	20	1.61	1.65	30	1.58	1.75
						31		1.62

Daily gage height, in feet, of Maniania ditch near Wailuku, Maui, in 1910–11—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.20	1.35	1.50	1.60	1.70	1.40	1.67	1.70	1.78	1.20	1.68	1.82
2	1.25	1.37	1.52	1.50	1.68	1.68	1.60	1.76	1.78	1.20	1.64	1.78
3	1.50	1.50	1.52	1.60	1.72	1.65	1.67	1.72	1.78	1.50	1.64	1.70
4	1.50	1.50	1.52	1.60	1.72	1.45	1.55	1.78	1.78	1.50	1.64	1.75
5	1.55	1.40	1.40	1.59	1.72	1.60	1.67	1.76	1.74	1.30	1.62	1.74
6	1.52	1.55	1.67	1.59	1.70	1.62	1.70	1.68	1.78	1.60	1.68	1.75
7	1.50	1.50	1.62	1.58	1.65	1.64	1.70	1.69	1.78	1.60	1.64	1.72
8	1.20	1.50	1.62	1.56	1.70	1.64	1.72	1.72	1.78	1.52	1.70	1.81
9	1.20	1.52	1.65	1.50	1.70	1.64	1.55	1.78	1.78	1.70	1.68	1.75
10	1.30	1.25	1.66	1.52	1.52	1.60	1.72	1.77	1.74	1.72	1.64	1.71
11	1.45	1.20	1.66	1.55	1.50	1.48	1.70	1.77	1.74	1.75	1.64	1.70
12	1.45	1.20	1.60	1.64	1.50	1.62	1.69	1.78	1.76	1.74	1.62	1.70
13	1.52	1.35	1.62	1.56	1.50	1.62	1.72	1.55	1.75	1.74	1.72	1.75
14	1.52	1.60	1.62	1.54	1.50	1.65	1.72	1.78	1.78	1.76	1.78	1.84
15	1.50	1.60	1.60	1.50	1.52	1.62	1.72	1.77	1.78	1.72	1.78	1.85
16	1.50	1.67	1.62	1.55	1.65	1.64	1.48	1.78	1.78	1.79	1.78	1.84
17	1.42	1.67	1.67	1.72	1.70	1.62	1.72	1.78	1.72	1.79	1.80	1.85
18	1.40	1.67	1.67	1.72	1.70	1.55	1.75	1.78	1.74	1.79	1.78	1.88
19	1.35	1.60	1.47	1.72	1.70	1.66	1.74	1.70	1.81	1.79	1.72	1.88
20	1.35	1.65	1.50	1.70	1.70	1.66	1.72	1.72	1.74	1.72	1.76	1.69
21	1.35	1.65	1.50	1.70	1.58	1.66	1.75	1.78	1.74	1.72	1.78	1.76
22	1.20	1.65	1.60	1.70	1.70	1.68	1.75	1.78	1.78	1.70	1.78	1.76
23	1.35	1.65	1.60	1.60	1.70	1.68	1.62	1.78	1.74	1.70	1.78	1.77
24	1.35	1.62	1.65	1.68	1.70	1.60	1.72	1.78	1.74	1.70	1.81	1.50
25	1.35	1.30	1.72	1.65	1.70	1.55	1.70	1.76	1.76	1.70	1.78	1.74
26	1.35	1.30	1.60	1.68	1.70	1.66	1.70	1.76	1.76	1.70	1.72	1.74
27	1.35	1.30	1.65	1.68	1.70	1.64	1.70	1.72	1.76	1.69	1.78	1.76
28	1.35	1.30	1.61	1.68	1.60	1.64	1.68	1.78	1.74	1.69	1.81	1.82
29	1.20	.....	1.72	1.68	1.65	1.65	1.68	1.78	1.74	1.64	1.84	1.88
30	1.35	.....	1.72	1.62	1.30	1.67	1.63	1.78	1.54	1.67	1.84	1.81
31	1.35	.....	1.60	.....	1.30	.....	1.66	1.78	.....	1.68	.....	1.42

Daily discharge, in second-feet, of Maniania ditch near Wailuku, Maui, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	17	11	.....	12	21	23	19
2	.....	17	12	.....	13	22	18	24
3	.....	17	13	.....	13	23	22	21
4	.....	17	14	15	22	24	28	24
5	.....	17	15	19	23	25	24	16
6	.....	14	16	16	21	26	22	17
7	.....	11	17	30	21	27	21	24
8	.....	7	18	27	14	28	32	24
9	.....	16	19	24	22	29	19	24
10	.....	14	20	17	20	30	18	24
						31	.....	91

Daily discharge, in second-feet, of Maniania ditch near Wailuku, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	10	13	16	19	22	14	21	22	26	10	21	28
2	11	13	16	16	21	21	19	25	26	10	20	26
3	16	16	16	19	23	20	21	23	26	16	20	22
4	16	16	16	19	23	15	17	26	26	16	20	24
5	17	14	14	18	23	19	21	25	24	12	19	24
6	16	17	21	18	22	19	22	21	26	19	21	24
7	16	16	19	18	20	20	22	22	26	19	20	23
8	10	16	19	17	22	20	23	23	26	16	22	27
9	10	16	20	16	22	20	17	26	26	22	21	24
10	12	11	21	16	16	19	23	25	24	23	20	22
11	15	10	21	17	16	16	22	25	24	24	20	22
12	15	10	19	20	16	19	22	26	25	24	19	22
13	16	13	19	17	16	19	23	17	24	24	23	24
14	16	19	19	17	16	20	23	26	26	25	26	29
15	16	19	19	16	16	19	23	25	26	23	26	29
16	16	21	19	17	20	20	16	26	26	26	26	29
17	14	21	21	23	22	19	22	26	23	26	27	29
18	14	21	21	23	22	17	24	26	24	26	26	32
19	13	19	15	23	22	21	24	22	27	26	23	32
20	13	20	16	22	22	21	23	23	24	23	25	22
21	13	20	16	22	18	21	24	26	24	23	26	25
22	10	20	16	22	22	21	24	26	26	22	26	25
23	13	20	19	19	22	21	19	26	24	22	26	25
24	13	19	20	21	22	19	23	26	24	22	27	16
25	13	12	23	20	22	17	22	25	25	22	26	24
26	13	12	19	21	22	21	22	25	25	22	23	24
27	13	12	20	21	22	20	22	23	25	22	26	25
28	13	12	19	21	19	20	21	26	24	22	27	28
29	10	.....	23	21	20	20	21	26	24	20	29	32
30	13	.....	23	19	12	21	20	26	17	21	29	27
31	13	.....	19	.....	12	.....	21	26	.....	21	.....	14

NOTE.—Daily discharge Nov. 14 to Nov. 25, 1910, computed by indirect method for shifting channels. From Nov. 26, 1910, to Dec. 31, 1911, daily discharge computed from a rating curve well defined between 15 and 35 second-feet.

Monthly discharge of Maniania ditch near Wailuku, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 14–30	32	15	22.1	745	B.
December	24	7	18.2	1,120	A.
1911.					
January	17	10	13.5	830	A.
February	21	10	16.0	889	A.
March	23	14	18.8	1,160	A.
April	23	16	19.3	1,150	A.
May	23	12	19.8	1,220	A.
June	21	14	19.3	1,150	A.
July	24	16	21.5	1,320	A.
August	26	17	24.5	1,510	A.
September	27	17	24.8	1,480	A.
October	26	10	20.9	1,290	A.
November	29	19	23.7	1,410	A.
December	32	14	25.1	1,540	A.
The year	32	10	20.6	14,900	

WAIKAPU STREAM BASIN.

GENERAL FEATURES.

The Waikapu basin is on the southeast slope of West Maui, south of Iao basin. It is a narrow, deep basin extending well back into the heart of the mountains and there receives a heavy rainfall. The stream is tributary to Maalaea Bay on the south side of the isthmus, but only storm water ever reaches the sea.

Several development tunnels have been driven into the mountain side to increase the water supply. Water is diverted through several ditches at various elevations, the largest of which is the Upper or South Side ditch. Gaging stations have been placed on the main stream and on the upper ditches on each side.

WAIKAPU STREAM NEAR WAIKAPU, MAUI.

A gaging station was established November 25, 1910, on Waikapu Stream at a point about 2 miles above Waikapu and about 5 miles south of Wailuku. The station is below the intakes of South Side and Palolo ditches.

A staff gage, graduated in tenths of feet, is fastened on the right bank about 200 feet below the trail crossing and is used to obtain gage heights.

The discharge at this station gives the flow of the stream below the South Side and Palolo ditches.

Discharge measurements of Waikapu Stream near Waikapu, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 25	C. H. Pierce	4.0	3.8	0.33	0.76
Dec. 31	Pierce and Schulz	12.0	15.4	1.45	29.9
1911.					
Jan. 5	....do	12.0	11.8	1.20	15.6
28	Martin and Pierce	13.6	28.5	2.30	126
Mar. 31	C. H. Pierce	12.5	8.2	0.85	7.2
Oct. 10	J. B. Stewart	7.2	4.1	0.65	3.02
Dec. 1	....do	2.5	.76	.37	.40

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Waikapu Stream near Waikapu, Maui, for 1910–11.

[Tanitsu, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	1.40	11	1.15	21	0.52
2	2.52	12	1.18	22	.52
3	1.49	13	1.08	23	.52
4	1.49	14	1.02	24	.60
5	2.06	15	.62	25	.60
6	2.63	16	.58	26	.60
7	1.62	17	.52	27	.60
8	1.42	18	.52	28	.60
9	1.34	19	.52	29	1.05
10	1.32	20	.52	30	1.08
				31	1.75

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.95	1.02	1.30	0.78	0.65	0.80	1.35	0.34	0.61	1.35	0.32	0.35
2	.72	1.08	.88	.65	.65	1.31	.92	.40	.69	1.00	.32	.35
3	.72	1.08	.72	.60	.72	1.51	.70	.38	.59	.71	.30	.35
4	1.16	1.08	.72	.60	.65	1.20	.65	.45	.46	.70	.30	.35
5	1.75	1.08	.70	.60	.65	1.28	.62	.45	.44	.52	.30	.35
6	1.06	1.15	.70	.60	.65	1.05	.70	.39	.40	.52	.30	.38
7	.97	1.08	.62	.60	.65	1.19	.68	.38	.64	1.32	.30	.35
8	.85	1.08	.60	.60	.65	1.00	.76	.35	.59	.84	.30	.69
9	.72	1.21	.60	.55	1.38	1.14	.76	.35	.41	.72	.30	.44
10	.88	2.05	.55	.52	1.42	1.49	1.00	.35	.45	.65	.30	.40
11	.82	1.40	.52	.52	1.10	1.05	1.62	.38	1.66	.62	.34	.40
12	.72	1.18	.50	.52	.94	.95	1.31	.41	1.18	.54	.35	.40
13	.72	1.00	.50	.50	.87	1.08	1.14	1.21	.62	.52	.55	.41
14	.72	.95	.50	.50	1.41	1.14	1.14	.60	.48	.51	1.11	.64
15	.65	.85	.50	.50	1.38	.91	.90	.41	.60	.48	.44	.51
16	.62	.85	.50	.50	1.29	1.12	1.38	.45	.45	.48	.48	.55
17	.95	.70	.92	.81	.90	1.09	.79	1.02	.46	.49	.30	.46
18	1.21	.70	.79	.90	.80	.96	.75	.91	.99	.45	.30	.55
19	1.28	.70	.72	.85	.80	1.10	.70	1.32	.58	.41	.32	.44
20	1.22	.62	.62	.80	.75	1.08	.68	.86	1.28	.38	.31	.42
21	1.28	.60	.55	1.11	1.32	1.28	.68	.45	.98	.38	.50	.40
22	1.15	.60	.52	1.15	1.08	1.04	.64	.41	1.32	.44	.51	.40
23	.96	.60	.50	1.35	.90	.91	.62	.39	1.95	.35	.68	.38
24	1.21	1.09	.50	1.26	.79	.78	.58	.92	1.25	.34	.34	.41
25	1.36	1.28	.50	1.22	.74	.94	.55	1.25	1.20	.34	.30	.42
26	1.18	1.19	.50	1.33	.80	.78	.42	1.05	2.20	.38	.30	.40
27	1.25	1.40	.50	1.08	.63	.70	.40	.59	1.21	.34	.36	.40
28	1.48	1.21	.50	.91	.61	.91	.40	.50	1.55	.34	1.05	.40
29	1.26	.....	.50	.82	1.00	.75	.40	1.46	1.16	.32	.41	.38
30	1.08	.....	1.22	.75	1.15	.68	.31	1.22	2.29	.32	.32	.40
31	1.02	.....	1.02	.....	1.01	.....	.30	.74	.....	.31	.....	.38

Daily discharge, in second-feet, of Waikapu Stream near Waikapu, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	27	11	16	21	1.7
2	158	12	17	22	1.7
3	32	13	13	23	1.7
4	32	14	11	24	2.5
5	90	15	2.8	25	2.5
6	175	16	2.3	26	2.5
7	42	17	1.7	27	2.5
8	28	18	1.7	28	2.5
9	24	19	1.7	29	12
10	23	20	1.7	30	13
				31	53

Daily discharge, in second-feet, of Waikapu Stream, near Waikapu, Maui, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	9.6	12	22	5.6	3.2	6.0	24	0.6	2.6	24	0.5	0.6
2	4.4	13	7.7	3.2	3.2	22	8.7	.9	3.8	11	.5	.6
3	4.4	13	4.4	2.5	4.4	33	4.0	.8	2.4	4.2	.4	.6
4	16	13	4.4	2.5	3.2	18	3.2	1.2	1.3	4.0	.4	.6
5	53	13	4.0	2.5	3.2	21	2.8	1.2	1.1	1.7	.4	.6
6	13	16	4.0	2.5	3.2	13	4.0	.8	.9	1.7	.4	.8
7	10	13	2.8	2.5	3.2	18	3.7	.8	3.1	23	.4	.6
8	7.0	13	2.5	2.5	3.2	11	5.2	.6	2.4	6.9	.4	3.8
9	4.4	18	2.5	2.0	26	15	5.2	.6	1.0	4.4	.4	1.1
10	7.7	89	2.0	1.7	28	33	11	.6	1.2	3.2	.4	.9
11	6.4	27	1.7	1.7	14	13	42	.8	45	2.8	.6	.9
12	4.4	17	1.5	1.7	9.3	9.6	22	1.0	17	1.9	.6	.9
13	4.4	11	1.5	1.5	7.4	13	16	18	2.8	1.7	2.0	1.0
14	4.4	9.6	1.5	1.5	28	16	16	2.5	1.4	1.6	14	3.1
15	3.2	7.0	1.5	1.5	26	8.5	8.3	1.0	2.5	1.4	1.1	1.6
16	2.8	7.0	1.5	1.5	22	15	26	1.2	1.2	1.4	1.4	2.0
17	9.6	4.0	8.8	6.2	8.3	14	5.8	12	1.3	1.4	.4	1.3
18	18	4.0	5.8	8.3	6.0	9.9	5.0	8.5	11	1.2	.4	2.0
19	21	4.0	4.4	7.2	6.0	14	4.0	23	2.3	1.0	.5	1.1
20	18	2.8	2.8	6.0	5.0	13	3.7	7.2	21	.8	.4	1.0
21	21	2.5	2.0	14	23	21	3.7	1.2	11	.8	1.5	.9
22	16	2.5	1.7	16	13	12	3.1	1.0	23	1.1	1.6	.9
23	9.9	2.5	1.5	24	8.3	8.5	2.8	.8	76	.6	3.7	.8
24	18	14	1.5	20	5.8	5.6	2.3	8.8	20	.6	.6	1.0
25	25	21	1.5	19	4.8	9.3	2.0	20	18	.6	.4	1.0
26	17	18	1.5	23	6.0	5.6	1.2	12	110	.8	.4	.9
27	20	27	1.5	13	2.8	4.0	.9	2.4	18	.6	.7	.9
28	32	18	1.5	8.5	2.6	8.5	.9	1.5	36	.6	12	.9
29	20	.....	1.5	6.4	11	5.0	.9	30	16	.5	1.0	.8
30	13	.....	19	5.0	13	3.7	.4	19	124	.5	.5	.9
31	12	.....	12	.....	11	.....	.4	4.8	.....	.4	.....	.8

NOTE.—Daily discharge determined from a rating curve well defined below 40 second-feet.

Monthly discharge of Waikapu Stream near Waikapu, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
December	175	1.7	25.7	1,580	B.
January	53	2.8	13.7	842	A.
February	89	2.5	14.7	816	A.
March	22	1.5	4.27	263	A.
April	24	1.5	7.12	424	A.
May	28	2.6	10.1	621	A.
June	33	3.7	13.3	791	A.
July	42	.4	7.72	475	A.
August	30	.6	5.96	366	A.
September	124	.9	19.2	1,140	B.
October	24	.4	3.43	211	A.
November	14	.4	1.60	95.2	A.
December	3.8	.6	1.09	67.0	A.
The year	124	.4	8.46	6,110	

NOTE.—These estimates do not include water diverted by the South Side and Palolo ditches.

SOUTH SIDE WAIKAPU DITCH NEAR WAIKAPU, MAUI.

The South Side ditch diverts water from Waikapu Stream above the gaging station on the stream. The station was established November 11, 1910, at a point a short distance above the upper Waikapu reservoir and 5 miles south of Wailuku.

A staff gage, graduated in tenths of feet, is fastened to the right bank and is used to obtain gage heights.

Records show the amount of water diverted from the south side of the stream. A part of this water is dropped back into the stream below the gaging station on Waikapu Stream.

Discharge measurements of South Side Waikapu ditch near Waikapu, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 11	C. H. Pierce	3.5	2.4	0.65	4.81
12	do	3.6	2.4	0.60	4.64
17[a]	do	3.6	2.6	0.65	5.8
Dec. 31	Pierce and Schulz	3.8	3.7	1.02	10.4
1911.					
Mar. 31	C. H. Pierce	3.5	3.0	0.90	8.6
Oct. 10	J. B. Stewart	4.6	3.6	0.85	7.2
Dec. 1	do	4.5	3.0	0.72	5.6

[a] Gage height probably affected by gate.

NOTE.—Measurements made at various sections.

Daily gage height, in feet, of South Side Waikapu ditch near Waikapu, Maui, for 1910–11.

[Tanitsu, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1		0.95	11			21	0.6	0.7
2		.9	12			22	.6	.75
3		.85	13			23	.7	.7
4		.9	14			24	.8	.75
5		.9	15		0.8	25	.7	.75
6		1.0	16		.8	26	.65	.7
7		.8	17		.8	27	.65	.7
8			18		.75	28	.65	.7
9			19		.75	29	1.0	.85
10			20		.75	30	.85	.9
						31		.9

Daily gage height, in feet, of South Side Waikapu ditch near Waikapu, Maui, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.7	0.6	0.85	0.8	0.8	0.8	0.9	0.85	0.8	0.9	0.8	0.7
2	.7	.8	.8	.8	.85	.9	.9	.85	.8	.9	.8	.7
3	.7	.8	.8	.8	.8	.9	.85	.85	.8	.9	.8	.65
4	.7	.9	.8	.8	.8	.85	.85	.85	.8	.85	.7	.65
5	.9	.9	.8	.8	.8	.9	.85	.8	.8	.8	.7	.65
6	.85	.9	.8	.8	.8	.8	.85	.8	.8	.8	.7	.7
7	.95	.85	.8	.75	.8	.9	.85	.8	.85	.9	.7	.6
8	.85	.85	.8	.75	.8	.85	.9	.8	.9	.85	.7	.85
9	.95	.9	.8	.75	.95	.9	.9	.8	.8	.85	.7	.7
10	.9	.9	.8	.75	1.0	.9	.9	.8	.8	.85	.7	.65
11	.8	.85	.8	.75	.8	.85	.9	.8	.9	.8	.7	.65
12	.8	.85	.8	.75	.8	.85	.9	.8	.9	.8	.7	.65
13	.8	.8	.8	.75	.8	.85	.9	.9	.85	.8	.85	.65
14	.8	.8	.8	.75	.85	.85	.9	.85	.8	.8	.9	.85
15	.8	.8	.8	.75	.85	.85	.85	.8	.8	.8	.75	.8
16	.8	.8	.8	.75	.8	.85	.9	.85	.8	.8	.7	.75
17	.9	.8	.9	.8	.8	.9	.9	.9	.8	.8	.7	.75
18	.8	.8	.85	.85	.8	.85	.85	.85	.9	.8	.7	.9
19	.7	.8	.85	.9	.8	.9	.85	.9	.8	.8	.7	.8
20	.7	.8	.8	.9	.8	.9	.85	.8	.9	.8	.7	.7
21	.7	.8	.8	.9	.9	.9	.85	.8	.85	.8	.9	.7
22	.7	.8	.8	.8	.95	.9	.85	.8	.9	.8	.9	.7
23	.65	.8	.8	.9	.8	.9	.8	.8	.9	.8	.9	.65
24	.85	.8	.8	.85	.8	.85	.85	.9	.9	.8	.8	.6
25	.7	.8	.8	.65	.8	.9	.8	.9	.9	.8	.8	.65
26	.65	.8	.8	.85	.8	.9	.85	.9	.9	.8	.7	.6
27	.65	.85	.8	.85	.8	.85	.85	.8	.9	.8	.7	.6
28	.8	.85	.8	.8	.8	.9	.85	.8	.9	.8	1.05	.6
29	.65	.....	.8	.8	.9	.9	.85	.9	.9	.8	.85	.6
30	.6	.....	.9	.8	.85	.9	.85	.9	.9	.8	.8	.6
31	.6	.....	.8	.....	.8	.....	.85	.85	.....	.8	.....	.6

Daily discharge, in second-feet, of South Side Waikapu ditch near Waikapu, Maui, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	9.1	11	.....	.....	21	4.5	5.4
2	.....	8.2	12	.....	.....	22	4.5	6.0
3	.....	7.4	13	.....	.....	23	5.4	5.4
4	.....	8.2	14	.....	.....	24	6.7	6.0
5	.....	8.2	15	.....	6.7	25	5.4	6.0
6	.....	10	16	.....	6.7	26	5.0	5.4
7	.....	6.7	17	.....	6.7	27	5.0	5.4
8	.....	.....	18	.....	6.0	28	5.0	5.4
9	.....	.....	19	.....	6.0	29	10	7.4
10	.....	.....	20	.....	6.0	30	7.4	8.2
						31	.....	8.2

Daily discharge, in second-feet, of South Side Waikapu ditch, near Waikapu, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	5.4	4.5	7.4	6.7	6.7	6.7	8.2	7.4	6.7	8.2	6.7	5.4
2	5.4	6.7	6.7	6.7	7.4	8.2	8.2	7.4	6.7	8.2	6.7	5.4
3	5.4	6.7	6.7	6.7	6.7	8.2	7.4	7.4	6.7	8.2	6.7	5.0
4	5.4	8.2	6.7	6.7	6.7	7.4	7.4	7.4	6.7	7.4	5.4	5.0
5	8.2	8.2	6.7	6.7	6.7	8.2	7.4	6.7	6.7	6.7	5.4	5.0
6	7.4	8.2	6.7	6.7	6.7	6.7	7.4	6.7	6.7	6.7	5.4	5.4
7	9.1	7.4	6.7	6.0	6.7	8.2	7.4	6.7	7.4	8.2	5.4	4.5
8	7.4	7.4	6.7	6.0	6.7	7.4	8.2	6.7	8.2	7.4	5.4	7.4
9	7.4	8.2	6.7	6.0	9.1	8.2	8.2	6.7	6.7	7.4	5.4	5.4
10	8.2	8.2	6.7	6.0	10	8.2	8.2	6.7	6.7	7.4	5.4	5.0
11	6.7	7.4	6.7	6.0	6.7	7.4	8.2	6.7	8.2	6.7	5.4	5.0
12	6.7	7.4	6.7	6.0	6.7	7.4	8.2	6.7	8.2	6.7	5.4	5.0
13	6.7	6.7	6.7	6.0	6.7	7.4	8.2	8.2	7.4	6.7	7.4	5.0
14	6.7	6.7	6.7	6.0	7.4	7.4	8.2	7.4	6.7	6.7	8.2	7.4
15	6.7	6.7	6.7	6.0	7.4	7.4	7.4	6.7	6.7	6.7	6.0	6.7
16	6.7	6.7	6.7	6.0	6.7	7.4	8.2	7.4	6.7	6.7	5.4	6.0
17	8.2	6.7	5.2	6.7	6.7	8.2	8.2	8.2	6.7	6.7	5.4	6.0
18	6.7	6.7	7.4	7.4	6.7	7.4	7.4	7.4	8.2	6.7	5.4	8.2
19	5.4	6.7	7.4	8.2	6.7	8.2	7.4	8.2	6.7	6.7	5.4	6.7
20	5.4	6.7	6.7	8.2	6.7	8.2	7.4	6.7	5.2	6.7	5.4	5.4
21	5.4	6.7	6.7	8.2	8.2	8.2	7.4	6.7	7.4	6.7	8.2	5.4
22	5.4	6.7	6.7	6.7	9.1	8.2	7.4	6.7	8.2	6.7	8.2	5.4
23	5.0	6.7	6.7	8.2	6.7	8.2	6.7	6.7	8.2	6.7	8.2	5.0
24	7.4	6.7	6.7	7.4	6.7	7.4	7.4	8.2	8.2	6.7	6.7	4.5
25	5.4	6.7	6.7	5.0	6.7	8.2	6.7	8.2	8.2	6.7	6.7	5.0
26	5.0	6.7	6.7	7.4	6.7	8.2	7.4	8.2	8.2	6.7	5.4	4.5
27	5.0	7.4	6.7	7.4	6.7	7.4	7.4	6.7	8.2	6.7	5.4	4.5
28	6.7	7.4	6.7	6.7	6.7	8.2	7.4	6.7	8.2	6.7	11	4.5
29	5.0	.....	6.7	6.7	8.2	8.2	7.4	8.2	8.2	6.7	7.4	4.5
30	4.5	.....	8.2	6.7	7.4	8.2	7.4	8.2	8.2	6.7	6.7	4.5
31	4.5	.....	6.7	.....	6.7	.....	7.4	7.4	.....	6.7	.....	4.5

NOTE.—Daily discharge computed from a rating curve well defined between 4 and 10 second-feet. The ditch was not carrying water during the period Dec. 8–14, 1910.

Monthly discharge of South Side Waikapu ditch near Waikapu, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 21–30	10	4.5	5.89	117	A.
December 1–7 and 15–31	10	5.4	6.86	326	A.
1911.					
January	9.1	4.5	6.28	386	A.
February	8.2	4.5	7.04	391	A.
March	8.2	6.7	6.87	422	A.
April	8.2	6.0	6.70	399	A.
May	10	6.7	7.15	440	A.
June	8.2	6.7	7.81	465	A.
July	8.2	6.7	7.63	469	A.
August	8.2	6.7	7.27	447	A.
September	8.2	6.7	7.47	444	A.
October	8.2	6.7	6.98	429	A.
November	11	5.4	6.37	379	A.
December	8.2	4.5	5.39	331	A.
The year	11	4.5	6.91	5,000	

PALOLO (EVERETT) DITCH NEAR WAIKAPU, MAUI.

Palolo ditch takes water from the north side of Waikapu Stream at a point about 1 mile below the upper South Side ditch.

A gaging station was established on this ditch November 21, 1910, about 200 feet below the intake.

A staff gage, graduated in tenths of feet, is fastened to the left bank and is used to obtain gage heights.

The records at this station show the amount of water diverted on the north side above the gaging station on Waikapu Stream.

Discharge measurements of Palolo ditch near Waikapu, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec. ft.*
Nov. 11	C. H. Pierce	3.4	2.3	0.94	3.84
17	....do	3.3	2.2	0.93	4.14
Dec. 31	Pierce and Schulz	3.3	2.5	1.03	5.2
1911.					
Jan. 5	....do	3.3	2.3	0.98	4.37
28	Martin and Pierce	3.6	2.7	1.00	4.86
Mar. 31	C. H. Pierce	2.8	0.9	0.55	1.07
Oct. 10	J. B. Stewart	5.3	4.0	1.05	3.58
Dec. 1	....do	5.1	3.9	.98	3.50

NOTE.—Measurements made at various sections.

Daily gage height, in feet, of Palolo ditch near Waikapu, Maui, for 1910–11.

[Tanitsu, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	0.95	11	.....	1.08	21	0.90	0.88
2	.....	.95	12	.....	1.05	22	.90	.90
3	.....	.84	13	.....	.98	23	.96	.90
4	.....	.85	14	.....	.95	24	.91	.90
5	.....	.91	15	.....	.88	25	.90	.92
6	.....	.85	16	.....	.88	26	.90	.92
7	.....	.80	17	.....	.88	27	.91	.90
8	.....	.66	18	.....	.88	28	.90	.90
9	.....	.58	19	.....	.88	29	.95	.91
10	.....	.60	20	.....	.88	30	.92	.92
						31	.....	.99

Daily gage height, in feet, of Palolo ditch near Waikapu, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.92	0.95	0.92	0.52	0.92	0.98	1.02	1.00	1.00	1.02	1.00	0.98
2	.92	.95	.88	.90	.95	1.00	1.00	1.00	1.00	1.00	.98	.95
3	.90	.95	.88	.88	.95	1.01	.99	1.00	1.00	1.00	.98	.95
4	.92	.95	1.00	.85	.95	1.00	.98	.99	1.00	1.05	.95	.95
5	.94	.95	1.00	.85	.95	.99	.96	.99	1.00	1.02	.95	.95
6	.92	.95	.95	.85	.95	.98	1.00	.99	1.00	1.05	.94	.95
7	.92	.95	.95	.85	.95	1.00	.96	.96	1.00	1.05	.95	.95
8	.90	.95	.95	.85	.95	.98	.98	.96	1.00	1.02	.95	1.06
9	.82	.95	.95	.85	1.05	1.00	.98	.95	.99	1.05	.95	1.02
10	.88	.....	.95	.95	1.08	1.00	1.00	.95	.99	1.05	.95	1.00
11	.82	.....	.95	.95	1.01	1.00	1.05	.96	1.09	1.04	.95	.98
12	.82	1.10	1.00	.95	.98	1.00	1.02	.98	1.01	1.02	.95	.98
13	.82	1.10	1.00	.95	.94	.99	1.00	1.01	1.00	1.02	1.02	.96
14	.82	1.10	1.00	.95	1.00	1.00	1.00	1.00	1.00	1.02	1.12	1.02
15	.82	.95	1.00	.95	1.00	.96	1.00	1.00	1.00	1.00	1.05	1.08
16	.82	.95	1.00	.95	1.00	1.00	1.04	1.00	1.00	1.00	1.06	1.08
17	.90	.95	1.02	1.00	.96	1.00	1.00	1.00	1.00	1.01	1.02	1.06
18	.48	.95	1.00	1.00	.94	1.00	1.00	1.00	1.02	1.00	1.02	1.08
19	.95	.95	1.02	1.00	.94	1.00	1.00	1.05	1.00	1.00	1.01	1.01
20	.95	.95	.98	1.00	.95	1.00	.96	1.00	1.08	1.00	1.02	1.01
21	.95	.95	.95	1.00	1.00	1.00	.95	1.00	1.04	1.00	1.08	.98
22	.95	.92	.95	1.02	1.00	1.00	.95	.99	1.08	1.02	1.09	.98
23	.94	.92	.95	1.02	.98	1.00	.96	1.00	1.08	1.00	1.10	.95
24	.92	1.09	.95	1.02	.95	1.00	.99	1.04	1.02	1.00	1.02	.98
25	.88	1.00	.95	1.05	.95	1.00	1.00	1.08	1.00	1.00	1.00	.99
26	.80	1.00	.95	1.02	.96	.99	1.00	1.02	1.10	1.00	1.00	.96
27	.82	.99	.95	.95	.95	.98	.99	1.00	1.05	1.00	1.01	.95
28	.91	.96	.95	.92	.92	1.00	1.00	1.00	1.14	1.00	1.11	.95
29	.86	.....	.92	.92	.96	.98	1.00	1.05	1.04	1.00	1.00	.95
30	.82	.....	1.04	.92	1.00	1.00	1.00	1.04	1.16	1.00	.99	.98
31	.95	.....	.52	.....	1.00	.....	.99	1.00	.....	1.00	.....	.95

Daily discharge, in second-feet, of Palolo ditch near Waikapu, Maui, for 1910–11.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1910.			1910.			1910.		
1	.....	4.2	11	.....	5.8	21	3.7	3.7
2	.....	4.2	12	.....	5.3	22	3.7	3.7
3	.....	3.2	13	.....	4.7	23	4.2	3.7
4	.....	3.2	14	.....	4.2	24	3.7	3.7
5	.....	3.7	15	.....	3.7	25	3.7	3.7
6	.....	3.2	16	.....	3.7	26	3.7	3.7
7	.....	2.8	17	.....	3.7	27	3.7	3.7
8	.....	1.8	18	.....	3.7	28	3.7	3.7
9	.....	1.5	19	.....	3.7	29	4.2	3.7
10	.....	1.5	20	.....	3.7	30	3.7	3.7
						31	.....	4.7

Daily discharge, in second-feet, of Palolo ditch near Waikapu, Maui, for 1910–11—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	3.7	4.2	3.7	1.0	3.7	4.4	4.0	3.7	3.4	3.4	3.4	3.4
2	3.7	4.2	3.7	3.7	4.2	4.4	4.0	3.7	3.4	3.4	3.4	3.0
3	3.7	4.2	3.7	3.7	4.2	4.4	4.0	3.7	3.4	3.4	3.4	3.0
4	3.7	4.2	4.7	3.2	4.2	4.4	4.0	3.7	3.4	3.8	3.0	3.0
5	4.2	4.2	4.7	3.2	4.2	4.4	3.6	3.7	3.4	3.4	3.0	3.0
6	3.7	4.2	4.2	3.2	4.2	4.4	4.0	3.7	3.4	3.8	3.0	3.0
7	3.7	4.2	4.2	3.2	4.2	4.4	3.6	3.3	3.4	3.8	3.0	3.0
8	3.7	4.2	4.2	3.2	4.2	4.4	4.0	3.3	3.4	3.4	3.0	3.8
9	2.8	4.2	4.2	3.2	4.9	4.4	4.0	3.3	3.4	3.8	3.0	3.4
10	3.7	[a] 4.2	4.2	4.2	5.5	4.4	4.0	3.3	3.4	3.8	3.0	3.4
11	2.8	[a] 5.8	4.2	4.2	4.4	4.4	4.6	3.3	4.3	3.8	3.0	3.4
12	2.8	5.8	4.7	4.2	4.4	4.4	4.0	3.7	3.4	3.4	3.0	3.4
13	2.8	5.8	4.7	4.2	3.9	4.4	4.0	3.7	3.4	3.4	3.4	3.0
14	2.8	5.8	4.7	4.2	4.4	4.4	4.0	3.7	3.4	3.4	4.3	3.4
15	2.8	4.2	4.7	4.2	4.4	3.9	4.0	3.7	3.4	3.4	3.8	4.3
16	2.8	4.2	4.7	4.2	4.4	4.0	4.6	3.7	3.4	3.4	3.8	4.3
17	3.7	4.2	4.7	4.7	3.9	4.0	4.0	3.7	3.4	3.4	3.4	3.8
18	1.0	4.2	4.7	4.7	3.9	4.0	4.0	3.7	3.4	3.4	3.4	4.3
19	4.2	4.2	4.7	4.7	3.9	4.0	4.0	4.2	3.4	3.4	3.4	3.4
20	4.2	4.2	4.7	4.7	3.9	4.0	3.6	3.7	4.3	3.4	3.4	3.4
21	4.2	4.2	4.2	4.7	4.4	4.0	3.6	3.7	3.8	3.4	4.3	3.4
22	4.2	3.7	4.2	4.7	4.4	4.0	3.6	3.7	4.3	3.4	4.3	3.4
23	4.2	3.7	4.2	4.7	4.4	4.0	3.6	3.7	4.3	3.4	4.3	3.0
24	3.7	5.8	4.2	4.7	3.9	4.0	3.7	4.7	3.4	3.4	3.4	3.4
25	3.7	4.7	4.2	5.2	3.9	4.0	3.7	4.8	3.4	3.4	3.4	3.4
26	2.8	4.7	4.2	4.7	3.9	4.0	3.7	3.7	4.3	3.4	3.4	3.0
27	2.8	4.7	4.2	4.2	3.9	4.0	3.7	3.7	3.8	3.4	3.4	3.0
28	3.7	4.2	4.2	3.7	3.5	4.0	3.7	3.7	5.4	3.4	4.3	3.0
29	3.2	.....	3.7	3.7	3.9	4.0	3.7	4.2	3.8	3.4	3.4	3.0
30	2.8	.....	5.2	3.7	4.4	4.0	3.7	4.2	5.4	3.4	3.4	3.4
31	4.2	.....	1.0	.....	4.4	.....	3.7	3.7	.....	3.4	.....	3.0

[a] Discharge interpolated.

NOTE.—Daily discharge based on rating curves applicable as follows: Nov. 21, 1910, to Mar. 31, 1911, well defined; Apr. 1 to Oct. 9, 1911, indirect method for shifting channels; Oct. 10 to Dec. 31, 1911, fairly well defined.

Monthly discharge of Palolo ditch near Waikapu, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
November 21–30	4.2	3.7	3.80	75.4	A.
December	5.8	1.5	3.52	216	A.
1911.					
January	4.2	1.0	3.42	210	A.
February	5.8	.....	4.50	250	A.
March	5.2	1.0	4.24	261	A.
April	5.2	1.0	3.99	237	C.
May	5.5	3.5	4.19	258	C.
June	4.4	3.9	4.18	249	C.
July	4.6	3.6	3.88	239	C.
August	4.8	3.3	3.74	230	C.
September	5.4	3.4	3.72	221	C.
October	3.8	3.4	3.48	214	B.
November	4.3	3.0	3.46	206	B.
December	4.3	3.0	3.35	206	B.
The year	5.8	1.0	3.84	2,780	

UKUMEHAME STREAM BASIN.

GENERAL FEATURES.

Ukumehame basin lies on the southwest slope of West Maui south of Olowalu basin and opposite the upper part of Waikapu on the other side of the island. It is about 1½ miles wide and 4 or 5 miles long.

This basin is on the lee side of the island where the rainfall is comparatively light except in the upper part.

Water is diverted through several ditches for irrigation. A gaging station has been established on the main stream above all diversions.

UKUMEHAME STREAM NEAR OLOWALU, MAUI.

A gaging station was established on Ukumehame Stream about 125 feet above the intake of the upper ditch August 14, 1911.

A staff gage, graduated in tenths of feet, is fastened to the left bank and is used for obtaining gage heights.

The Olowalu Sugar Co. cooperates in maintaining this station by having its ditchman read the gage.

Discharge measurements of Ukumehame Stream near Olowalu, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 14	J. B. Stewart	15.9	14.3	0.70	9.1
Oct. 20	.....do	13.2	15.4	0.52	8.2

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Ukumehame Stream near Olowalu, Maui, for 1911.

[E. Haneburg, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.75	0.9	0.5	0.5	16	0.7	0.7	0.55	0.5	0.6
2	.....	.7	.7	.5	.5	17	.8	.7	.55	.5	.55
3	.....	.7	.7	.5	.5	18	.8	.85	.55	.5	.6
4	.....	.75	.65	.5	.5	19	1.05	.8	.55	.5	.6
5	.....	.7	.7	.5	.5	20	.7	.95	.5	.5	.6
6	.....	.7	.6	.5	.5	21	.8	1.4	.5	.55	.6
7	.....	.8	.8	.5	.5	22	.7	.95	.5	.65	.5
8	.....	.75	.7	.5	.5	23	.7	.95	.5	.60	.5
9	.....	.7	.65	.5	.5	24	.7	.9	.5	.55	.5
10	.....	.7	.6	.5	.5	25	.95	.8	.5	.5	.5
11	.....	1.05	.6	.5	.5	26	.9	1.0	.5	.5	.5
12	.....	1.0	.6	.5	.5	27	.8	.8	.5	.5	.5
13	.....	.9	.6	.6	.5	28	.7	.95	.5	.6	.5
14	0.7	.75	.55	.75	.6	29	.9	.8	.5	.55	.5
15	.65	.7	.55	.6	.75	30	.95	1.0	.5	.5	.5
						31	.8	.....	.5	.....	.5

Daily discharge, in second-feet, of Ukumehame Stream near Olowalu, Maui, for 1911.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	9.4	11	8.1	8.1	16	9.1	9.1	8.3	8.1	8.5
2	.....	9.1	9.1	8.1	8.1	17	9.8	9.1	8.3	8.1	8.3
3	.....	9.1	9.1	8.1	8.1	18	9.8	10	8.3	8.1	8.5
4	.....	9.4	8.8	8.1	8.1	19	12	9.8	8.3	8.1	8.5
5	.....	9.1	9.1	8.1	8.1	20	9.1	12	8.1	8.1	8.5
6	.....	9.1	8.5	8.1	8.1	21	9.8	16	8.1	8.3	8.5
7	.....	9.8	9.8	8.1	8.1	22	9.1	12	8.1	8.8	8.1
8	.....	9.4	9.1	8.1	8.5	23	9.1	12	8.1	8.5	8.1
9	.....	9.1	8.8	8.1	8.1	24	9.1	11	8.1	8.3	8.1
10	.....	9.1	8.5	8.1	8.1	25	12	9.8	8.1	8.1	8.1
11	.....	12	8.5	8.1	8.1	26	11	12	8.1	8.1	8.1
12	.....	12	8.5	8.1	8.1	27	9.8	9.8	8.1	8.1	8.1
13	.....	11	8.5	8.5	8.1	28	9.1	12	8.1	8.5	8.1
14	9.1	9.4	8.3	9.4	8.5	29	11	9.8	8.1	8.3	8.1
15	8.8	9.1	8.3	8.5	9.4	30	12	12	8.1	8.1	8.1
						31	9.8	.....	8.1	.....	8.1

NOTE.—Daily discharge computed from a rating curve that is poorly defined.

Monthly discharge of Ukumehame River near Olowalu, Maui, Aug. 14 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August 14–31	12	8.8	9.97	356	D.
September	16	9.1	10.4	619	D.
October	11	8.1	8.53	524	C.
November	9.4	8.1	8.24	490	C.
December	9.4	8.1	8.24	507	C.

OLOWALU STREAM BASIN.

OLOWALU DITCH NO. 1 NEAR OLOWALU, MAUI.

Olowalu basin lies on the southwest slope of West Maui north of Ukumehame basin and south of upper Iao basin. It is about 5 miles long and about 1½ miles wide. Two development tunnels have been driven into the sides of the mountain for increasing the water supply.

The rainfall is comparatively light except in the upper part of the basin.

Water is diverted through several ditches for power and irrigation.

A gaging station was established on the upper main ditch, which is called Olowalu ditch No. 1, August 12, 1911. This ditch supplies water for the development of electric power, after which the water is used for irrigation on the lower lands.

The station is in the flume a short distance below the power house. Ordinarily this ditch carries the total flow of the stream.

The records show the amount of water used to develop power for pumping and lighting.

Discharge measurements of Olowalu ditch No. 1, near Olowalu, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 12	J. B. Stewart	3.0	2.4	0.50	6.5
Oct. 20	do	3.0	2.4	0.45	5.5

NOTE.—Several additional measurements made early in 1912 were used in determining the rating. Measurements made at various sections.

Daily discharge, in second-feet, of Olowalu ditch No. 1, near Olowalu, Maui, for 1911.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	13	11	4.5	6.6	16	9.3	9.3	6.6	11	15
2	.....	9.3	4.5	5.6	4.5	17	9.3	9.3	6.6	9.3	13
3	.....	9.3	4.5	4.5	4.5	18	9.3	17	6.6	9.3	13
4	.....	13	4.5	4.5	4.5	19	11	13	6.6	6.6	17
5	.....	9.3	3.0	4.5	4.5	20	9.3	17	5.6	6.6	17
6	.....	9.3	3.0	4.5	4.5	21	9.3	13	[a] 5.6	9.3	13
7	.....	13	6.6	4.5	6.6	22	6.6	3.8	[a] 5.6	9.3	9.3
8	.....	13	4.5	4.5	13	23	8.0	13	[a] 6.1	17	8.0
9	.....	9.3	3.0	4.5	6.6	24	9.3	11	[a] 6.6	13	6.6
10	.....	9.3	3.0	4.5	6.6	25	13	4.5	[a] 6.6	9.3	6.6
11	.....	17	6.6	4.5	4.5	26	13	9.3	6.6	6.6	5.6
12	8.0	13	11	4.5	4.5	27	13	8.0	6.6	6.6	6.6
13	17	17	9.3	4.5	5.6	28	9.3	8.0	6.6	15	6.6
14	9.3	13	11	9.3	17	29	11	6.6	5.6	13	6.6
15	9.3	9.3	8.0	13	17	30	17	9.3	4.5	6.6	4.5
						31	13	.....	4.5	.....	4.5

[a] Discharge estimated.

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 15 second-feet.

Monthly discharge of Olowalu ditch No. 1, near Olowalu, Maui, for Aug. 12 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August 12–31	17	6.6	10.7	424	B.
September	17	3.8	11.0	655	B.
October	11	3.0	6.14	378	B.
November	17	4.5	7.68	457	B.
December	17	4.5	8.50	523	B.

LAUNIUPOKO STREAM BASIN, MAUI.

LAUNIUPOKO STREAM NEAR LAHAINA, MAUI.

Launiupoko basin lies on the western slope of West Maui north of Olowalu, and south of Kauaula basins. It has a length of 4 or 5 miles and is contiguous to Iao basin in its upper part. One development channel has been driven into the mountain side of this basin for increasing the water supply. The rainfall is comparatively light except in the upper part. Water is diverted for irrigation through Launiupoko ditch.

A gaging station was established on Launiupoko Stream about 175 feet above the Pioneer Mill Co.'s stone flume intake July 25, 1911.

A staff gage, graduated into tenths of feet, is located on the right bank and is used for obtaining gage heights. The station is about 4 miles southeast of Lahaina. The records show the total flow of the stream above all diversions.

Discharge measurements of Launiupoko Stream near Lahaina, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 25	J. B. Stewart	5.5	1.6	0.50	1.81
Oct. 14	do	4.5	1.3	.50	1.61

NOTE.—An additional measurement made early in 1912 was used in determining the rating. Measurements made at various sections.

Mean daily discharge, in second-feet, of Launiupoko Stream near Lahaina, Maui, for 1911.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.7	1.4	2.5	1.4	1.4	16	.....	2.1	1.7	1.7	1.7	2.5
2	.....	1.7	1.1	1.7	1.4	1.4	17	.....	1.7	1.4	1.7	1.7	1.7
3	.....	1.7	1.1	1.7	1.4	1.4	18	.....	1.7	2.5	1.7	1.7	2.1
4	.....	1.7	1.7	1.7	1.4	1.4	19	.....	3.3	1.7	1.7	1.7	1.7
5	.....	1.7	1.4	1.7	1.4	1.4	20	.....	1.7	3.8	1.4	1.7	1.7
6	.....	1.7	1.4	1.7	1.4	1.4	21	.....	1.7	9.6	1.4	1.7	1.7
7	.....	1.7	1.4	1.7	1.4	1.4	22	.....	1.7	3.3	1.4	1.7	1.7
8	.....	1.7	1.4	1.7	1.4	1.7	23	.....	1.7	3.3	1.4	1.7	1.7
9	.....	1.7	1.7	1.7	1.4	1.7	24	.....	1.7	4.2	1.4	1.7	1.7
10	.....	1.7	1.4	1.7	1.4	1.4	25	1.7	2.1	4.2	1.4	1.7	1.4
11	.....	1.7	3.3	1.7	1.4	1.7	26	1.7	2.1	6.6	1.4	1.7	1.4
12	.....	1.7	2.5	1.7	1.4	1.7	27	1.7	1.7	3.3	1.4	1.4	1.7
13	.....	2.1	1.7	1.7	1.7	1.7	28	1.7	1.7	3.3	1.4	1.4	1.7
14	.....	1.7	1.7	1.7	4.2	2.9	29	1.7	1.7	3.3	1.4	1.4	1.7
15	.....	2.1	1.7	1.7	1.7	2.9	30	1.7	3.8	4.2	1.4	1.4	1.7
							31	1.7	2.1	.....	1.4	.....	1.7

NOTE.—Daily discharge computed from a rating curve that is poorly defined.

Monthly discharge of Launiupoko Stream near Lahaina, Maui, for July 25 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 25–31	1.7	1.7	1.70	23.6	D.
August	3.8	1.7	1.90	117	D.
September	9.6	1.1	2.71	161	D.
October	2.5	1.4	1.61	99	D.
November	4.2	1.4	1.62	96.4	D.
December	2.9	1.4	1.72	106	D.

KAUAULA STREAM BASIN.

GENERAL FEATURES.

Kauaula Stream basin is on the west slope of West Maui, opposite Iao, north of Launiupoko and south of Lahainaluna basins. It is 5 or 6 miles long and about 2 miles wide. One development tunnel has been driven into the north side of the mountain for increasing the water supply.

The rainfall is comparatively light except in the upper part of the basin.

Water for irrigation is diverted through several ditches.

Gaging stations have been established on the stream and the upper main ditch.

KAUAULA STREAM NEAR LAHAINA, MAUI.

A gaging station was established on the main stream October 16, 1911, at a point a short distance above the intake of Piilanu ditch, and also on Kauaula ditch which diverts water above.

On account of shifting channel and poor location of gage in the main stream the gage heights are unreliable and can not be used. The headgates of the upper ditch were regulated so as to admit a flow of about 3.1 second-feet into the ditch from October 16 to December 31.

Discharge measurements of Kauaula Stream near Lahaina, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
July 28[a]	J. B. Stewart	4.2	3.6	0.38	10.7
Aug. 1[a]	.....do	4.2	3.7	0.38	10.2
Oct. 6[b]	.....do	.....	.....	0.10	9.1

[a] Measurement made in Piilani ditch at intake and represents total flow of stream.
[b] Discharge obtained from combined flow of New Kauaula ditch and Piilani ditch at their intakes.

KAUAULA WEIRS NOS. 1, 2, AND 3, NEAR LAHAINA, MAUI.

During the early part of 1901 the Pioneer Mill Co. established weirs at three points on Kauaula Stream and maintained records for a few weeks. Weir No. 1 was 6 feet in length and was established on the North Fork. Weir No. 2 was 3 feet in length and was established on the South Fork. Weir No. 3 was 6 feet in length and was established on the main stream about 400 feet above the intake of Piilani ditch. These weirs show the total flow of the North and South forks and main stream, respectively.

The records have been furnished by the Pioneer Mill Co.

Daily discharge, in second-feet, of North Fork of Kauaula Stream at weir No. 1, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1	.....	3.9	11	3.4	.....	21	5.3	.....
2	3.5	3.7	12	3.4	.....	22	4.5	.....
3	3.8	3.6	13	5.2	.....	23	6.1	.....
4	3.7	4.0	14	5.9	.....	24	4.3	.....
5	3.4	4.3	15	4.6	.....	25	3.9	.....
6	3.6	7.9	16	3.9	.....	26	3.9	.....
7	3.6	(a)	17	12	.....	27	3.9	.....
8	3.7	(a)	18	10	.....	28	3.9	.....
9	3.7	12	19	5.1	.....	29	4.1	.....
10	3.6	8.4	20	8.4	.....	30	3.7	.....
						31	4.1	.....

[a] High water. No readings made.

Daily discharge, in second-feet, of South Fork of Kauaula Stream at weir No. 2, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1	.....	1.3	11	1.3	.....	21	1.6	.....
2	1.3	.8	12	1.3	.....	22	1.4	.....
3	1.4	.8	13	1.6	.....	23	1.6	.....
4	1.3	1.2	14	1.6	.....	24	1.3	.....
5	1.4	1.6	15	1.4	.....	25	1.3	.....
6	1.3	2.3	16	1.3	.....	26	1.6	.....
7	1.3	(a)	17	2.5	.....	27	1.2	.....
8	1.3	(a)	18	1.9	.....	28	1.3	.....
9	1.4	4.2	19	1.4	.....	29	1.3	.....
10	1.3	4.3	20	2.1	.....	30	1.2	.....
						31	1.4	.....

a High water. No readings made.

Daily discharge, in second-feet, of Kauaula Stream at weir No. 3, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1	.....	4.7	11	.....	.....	21	.....	.....
2	.....	4.5	12	.....	.....	22	.....	.....
3	.....	4.2	13	.....	.....	23	.....	.....
4	.....	4.3	14	.....	.....	24	.....	.....
5	.....	4.9	15	.....	.....	25	.....	.....
6	.....	8.9	16	.....	.....	26	.....	.....
7	.....	(a)	17	.....	.....	27	.....	.....
8	.....	(a)	18	.....	.....	28	.....	.....
9	.....	14	19	.....	.....	29	.....	.....
10	.....	12	20	.....	.....	30	.....	.....
						31	4.9	.....

a High water. No readings made.

LAHAINALUNA STREAM BASIN.

GENERAL FEATURES.

Lahainaluna basin lies on the western slope of West Maui north of Kauaula basin and south of Kahoma basin. The basin is very narrow but extends back to the summit of Puu Kukui. Lahainaluna Stream joins Kahoma Stream about 1 mile from the sea.

LAHAINALUNA STREAM NEAR LAHAINA, MAUI.

A gaging station was established August 5, 1911, on Lahainaluna Stream at a point about 8 feet above the Pioneer Mill Co.'s upper intake and about 25 feet below the overflow from the flume of Lahaina waterworks.

A staff gage, graduated into tenths of feet, is used to obtain gage heights. The discharge at this station shows the total flow of the stream exclusive of the amount taken by the Lahaina waterworks flume.

Discharge measurements of Lahainaluna Stream near Lahaina, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 2	J. B. Stewart	4.0	1.2	0.27	2.01
Oct. 18	do	3.2	1.0	0.19	1.24

NOTE.—Measurements made in Pioneer Mill Co's ditch which was carrying total flow of stream.

Daily gage height, in feet, of Lahainaluna Stream near Lahaina, Maui, for 1911.

[O. Brecht, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.24	0.26	0.20	0.20	16	0.25	0.20	0.17	0.20	0.45
2	.....	.20	.21	.20	.20	17	.44	.29	.18	.90	.45
3	.....	.20	.71	.20	.20	18	.27	.20	.19	.40	.85
4	.....	.20	.53	.20	.20	19	1.60	.38	.18	.40	1.00
5	0.22	.20	.40	.20	.20	20	.28	.95	.19	.50	.37
6	.24	.20	.27	.24	.24	21	.24	.90	.20	.36	.27
7	.22	.68	.46	.20	.30	22	.20	1.50	.20	.90	.24
8	.23	.72	.34	.32	.20	23	.20	.34	.20	.37	.22
9	.29	.33	.22	.20	.20	24	.50	.52	.17	.22	.23
10	.22	.25	.20	.20	.20	25	.45	.35	.18	.20	.22
11	.20	1.10	.24	.19	.18	26	.46	.24	.20	.20	.23
12	.25	.33	.28	.20	.18	27	.26	.70	.20	.20	.22
13	.30	.20	.19	.39	.20	28	.24	.56	.20	.32	.25
14	.34	.20	.18	.61	1.50	29	.20	74	.20	.20	.34
15	.24	.35	.18	.42	1.66	30	.20	.28	.20	.20	.24
						31	.25	.....	.20	.....	.24

Daily discharge, in second-feet, of Lahainaluna Stream near Lahaina, Maui, for 1911.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.7	1.9	1.3	1.3	16	1.8	1.3	1.0	1.3	4.3
2	.....	1.3	1.4	1.3	1.3	17	4.2	2.3	1.1	11	4.7
3	.....	1.3	8.1	1.3	1.3	18	2.0	1.3	1.2	3.6	10
4	.....	1.3	5.4	1.3	1.3	19	25	3.4	1.1	3.6	13
5	1.5	1.3	3.6	1.3	1.3	20	2.1	12	1.2	5.0	3.2
6	1.7	1.3	2.0	1.7	1.7	21	1.7	11	1.3	3.1	2.0
7	1.5	7.7	4.4	1.3	2.4	22	1.3	23	1.3	11	1.7
8	1.6	8.2	2.9	2.6	1.3	23	1.3	2.9	1.3	3.2	1.5
9	2.3	2.8	1.5	1.3	1.3	24	5.0	5.3	1.0	1.5	1.6
10	1.5	1.8	1.3	1.3	1.3	25	4.3	3.0	1.1	1.3	1.5
11	1.3	15	1.7	1.2	1.1	26	4.4	1.7	1.3	1.3	1.6
12	1.8	2.8	2.1	1.3	1.1	27	1.9	8.0	1.3	1.3	1.5
13	2.4	1.3	1.2	3.5	1.3	28	1.7	5.9	1.3	2.6	1.8
14	2.9	1.3	1.1	6.7	23	29	1.3	8.7	1.3	1.3	2.9
15	1.7	3.0	1.1	3.9	26	30	1.3	2.1	1.3	1.3	1.7
						31	1.8	.....	1.3	.....	1.7

NOTE.—Daily discharge computed from a rating curve that is poorly defined. Above 3 second-feet the estimates are only approximate.

Monthly discharge of Lahainaluna Stream near Lahaina, Maui, for Aug. 5 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August 5–31	25	1.3	3.01	161	D.
September	23	1.3	4.80	286	D.
October	8.1	1.0	1.91	117	D.
November	11	1.2	2.79	166	D.
December	26	1.1	3.93	242	D.

LAHAINALUNA WEIRS NOS. 1 AND 2, NEAR LAHAINA, MAUI.

The Pioneer Mill Co. established two weirs on the Lahainaluna Stream early in 1901. The upper weir, known as No. 1, was placed about 4 miles above the junction of this stream with Kahoma Stream. The second weir, known as No. 2, was placed about 1½ miles above the junction with Kahoma Stream. Five-foot weirs were used. The records, which were kept for a few weeks only, have been furnished the Geological Survey by the Pioneer Mill Co.

Daily discharge, in second-feet, of Lahainaluna Stream at weir No. 1, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1		4.8	11			21	6.8	
2		4.6	12			22	5.7	
3		4.6	13			23	8.7	
4		4.6	14			24	5.4	
5		4.6	15			25	5.2	
6			16			26	4.7	
7			17			27	4.8	
8			18			28	4.8	
9			19	5.7		29	4.8	
10			20	(a)		30	4.7	
						31	4.8	

a High water; no reading.

Daily discharge, in second-feet, of Lahainaluna Stream at weir No. 2, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1		4.9	11			21		
2		4.8	12			22	4.2	
3		4.5	13			23	12	
4		4.5	14			24	4.8	
5		4.7	15			25	4.7	
6		8.1	16			26	4.8	
7			17			27	4.8	
8			18			28	4.9	
9			19			29	4.9	
10			20			30	4.7	
						31	4.8	

KAHOMA STREAM BASIN.

GENERAL FEATURES.

Kahoma basin lies on the western slope of West Maui just north of Lahainaluna basin. Kahoma Stream rises at the summit of Puu Kukui and joins the Lahainaluna Stream about 1 mile from the sea.

Two development tunnels have been driven into the side of the mountain for increasing the water supply.

Water is diverted for irrigation through Kahoma ditch.

KAHOMA STREAM NEAR LAHAINA, MAUI.

A gaging station was established on Kahoma Stream below the intake of Kahoma ditch August 17, 1911.

The gage is on the left bank about 125 feet above the lower dam. It is read during flood periods only, as the normal flow and water from development tunnels is diverted into Kahoma ditch about 600 feet above. No discharge measurements have been made.

Daily gage height, in feet, of Kahoma Stream near Lahaina, Maui, for 1911.

[E. C. Bortfeld, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1			0.35			16	0.6	0.5			0.1
2						17	.6	.95		0.15	.1
3			.05			18	.3	1.15		.05	.1
4			.25			19	2.1			.05	.1
5			.55			20	1.3	1.55		.05	.05
6					0.05	21		1.1		.05	
7		0.95	1.0		.05	22		.4		.15	
8		1.0	.35	0.05	.15	23		.85		.05	
9		.3				24	.05	.7		.05	
10						25	.05	.4			
11		1.75				26		1.4			
12		1.4				27		.9			
13	0.4			.1		28		.85		.2	
14				.1	.15	29	1.3	1.0			
15		.6		.1	.1	30	1.3	.05			

NOTE.—From Aug. 1 to Dec. 31, where no gage heights appear, stream was dry.

KAHOMA STREAM AT WEIRS NOS. 1 AND 2, NEAR LAHAINA, MAUI.

The Pioneer Mill Co. established two 5-foot weirs on Kahoma Stream in 1901 and kept a record for a few weeks only. The location of the weirs is not known except that No. 1 is above No. 2. The records have been furnished by the Pioneer Mill Co.

Daily discharge, in second-feet, of Kahoma Stream at weir No. 1, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1		4.8	11		6.4	21	3.3	
2		3.8	12	3.2		22	3.2	
3		3.5	13	3.2		23	12	
4		3.4	14	8.4		24	3.5	
5		3.3	15	4.4		25	3.4	
6		13	16	3.8		26	3.3	
7		(a)	17	12		27	3.5	
8		17	18	10		28	3.4	
9		(a)	19	4.1		29	4.4	
10		4.9	20	11		30	3.5	
						31	3.5	

a High water. No readings made.

Daily discharge in second-feet, of Kahoma Stream at weir No. 2, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1		5.0	11		6.4	21		
2		3.9	12			22		
3		3.8	13			23		
4		3.8	14			24	4.3	
5		3.8	15			25	3.9	
6		13	16			26	3.8	
7		(a)	17			27	3.8	
8		17	18			28	3.6	
9		(a)	19			29	5.2	
10		4.9	20			30	3.8	
						31	3.8	

a High water. No readings made.

KAHOMA DITCH AT WEIR, NEAR LAHAINA, MAUI.

A 4-foot weir has been placed in Kahoma ditch just below the intake by the Pioneer Mill Co. This weir measures the flow of the stream at low stages and also the water developed by tunnels. The records for this weir since August 1, 1911, have been furnished to the Geological Survey by the Pioneer Mill Co.

Discharge measurements of Kahoma ditch at weir, near Lahaina, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 23	J. B. Stewart	5.0	2.0	a 0.45	4.75
Oct. 18	do	4.2	2.5	b .48	4.45

a Gage height is head over old 4′ weir.
b Gage height is head over new 4′ weir. Constructed Aug. 1, 1911.

Daily discharge, in second-feet, of Kahoma ditch at weir, near Lahaina, Maui, for 1911.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.8	4.8	6.7	4.0	4.3	16	9.9	6.2	4.4	4.8	8.5
2	4.8	3.8	5.1	4.2	4.3	17	9.9	7.5	4.3	8.6	8.5
3	5.0	4.3	5.9	4.0	4.3	18	8.1	6.8	4.4	7.8	8.0
4	5.0	4.0	7.8	4.0	4.3	19	10	5.0	4.3	7.0	8.5
5	5.0	4.4	7.3	4.0	4.3	20	8.0	7.8	4.3	6.8	6.5
6	5.3	4.7	6.5	5.7	5.4	21	6.8	7.5	4.3	8.1	5.1
7	5.3	6.8	8.6	5.3	6.7	22	5.3	8.1	4.3	7.8	5.1
8	5.3	7.5	7.1	7.1	8.5	23	5.3	8.6	4.3	7.8	4.7
9	5.3	6.4	5.3	5.0	5.0	24	10	8.1	4.3	7.1	4.7
10	5.0	5.6	4.7	4.7	4.7	25	10	7.0	4.2	5.0	4.6
11	4.8	7.8	4.7	4.4	4.7	26	10	9.2	4.2	4.4	4.6
12	4.8	6.8	4.7	4.2	4.7	27	6.7	7.8	4.2	4.3	4.6
13	5.3	4.4	4.4	8.6	5.9	28	6.4	9.5	4.2	7.5	5.3
14	5.3	4.0	4.4	8.6	8.6	29	10	8.5	4.2	4.7	7.1
15	5.0	6.5	4.4	8.6	8.6	30	10	6.7	4.2	4.4	4.8
						31	6.4	.....	4.2	.....	5.3

NOTE.—Daily discharge computed by the Geological Survey from records of head on 4-foot weir furnished by the Pioneer Mill Co.

Monthly discharge of Kahoma ditch at weir, near Lahaina, Maui, for Aug. 1 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August	10	4.8	6.74	414
September	9.5	3.8	6.54	389
October	8.6	4.2	5.03	309
November	8.6	4.0	5.95	354
December	8.6	4.3	5.81	357

HONOKAWAI STREAM BASIN.

GENERAL FEATURES.

Honokawai basin lies on the northwestern slope of West Maui. The upper part of the basin touches Kahoma basin at the south and Honokahau basin at the east. The principal tributary is Amalu Stream, which enters from the north below the intake of the power ditch. Two development tunnels have been driven into the side of the mountain for increasing the water supply.

Water is diverted from the south side for power development, after which it is used for irrigation.

HONOKAWAI STREAM NEAR LAHAINA, MAUI.

A gaging station was established on Honokawai Stream at the intake of the power ditch about 3 miles above the power house, August 1, 1911. The gage is on the right side of the stream about 15 feet below the lower development tunnel and about 400 feet above Amalu Stream.

The discharge at this point gives the total flow of the stream, including the water from two development tunnels.

Discharge measurements of Honokawai Stream near Lahaina, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 26	J. B. Stewart	.....	.....	0.79	[a] 7.3
Oct. 17[b]	.....do	2.8	3.9	1.05	10.2

[a] Discharge at gage was determined by measuring two tunnels which develop water above gage.
[b] Measurement in Honokawai ditch, which was diverting total flow of stream.

Daily gage height, in feet, of Honokawai Stream near Lahaina, Maui, for 1911.

[E. C. Bortfeld, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.86	0.74	0.94	0.70	0.70	16	1.28	0.80	0.72	0.71	1.05
2	1.10	.72	.78	.70	.70	17	1.42	.90	.98	1.45	1.12
3	.88	.72	1.00	.70	.68	18	1.20	.90	.75	.96	1.30
4	.76	.95	1.20	.70	.69	19	1.50	.78	.72	.95	1.55
5	.85	.78	1.12	.72	.70	20	.84	1.88	.72	.80	.80
6	.74	.76	1.11	.78	.95	21	.74	1.08	.74	1.32	.80
7	.72	1.30	.90	.72	.88	22	.71	1.15	.71	1.02	.75
8	.75	1.30	1.06	1.00	1.65	23	.72	1.58	.70	1.10	.70
9	.98	.98	.82	.76	.75	24	1.36	1.22	.70	1.12	.70
10	.88	.88	.75	.74	.70	25	1.40	.91	.70	.75	.70
11	.74	1.68	.72	.74	.75	26	1.20	1.22	.70	.70	70
12	.72	1.05	.72	.72	.75	27	.76	1.58	.70	.70	.70
13	1.12	.76	.72	1.45	.82	28	.74	1.20	.70	1.18	.70
14	.98	.74	.72	1.65	1.55	29	.74	.92	.70	.78	.90
15	.76	1.10	.72	1.08	1.50	30	1.50	1.25	.70	.70	.75
						31	.76	.....	.70	.....	.78

Daily discharge, in second-feet, of Honokawai Stream near Lahaina, Maui, for 1911.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.9	6.6	8.8	6.4	6.4	16	14	7.3	6.6	6.5	10
2	11	6.6	7.2	6.4	6.4	17	16	8.4	9.2	17	11
3	8.1	6.6	9.6	6.4	6.2	18	12	8.4	6.9	9.0	14
4	7.0	8.9	12	6.4	6.3	19	18	7.2	6.6	8.9	19
5	7.8	7.2	11	6.6	6.4	20	7.7	26	6.6	7.3	7.3
6	6.8	7.0	11	7.2	8.9	21	6.8	11	6.8	14	7.3
7	6.6	14	8.4	6.6	8.1	22	6.5	12	6.5	9.8	6.9
8	6.9	14	10	9.6	21	23	6.6	20	6.4	11	6.4
9	9.2	9.2	7.5	7.0	6.9	24	15	12	6.4	11	6.4
10	8.1	8.1	6.9	6.8	6.4	25	16	8.5	6.4	6.9	6.4
11	6.8	22	6.6	6.8	6.9	26	12	12	6.4	6.4	6.4
12	6.6	10	6.6	6.6	6.9	27	7.0	20	6.4	6.4	6.4
13	11	7.0	6.6	17	7.5	28	6.8	12	6.4	12	7.2
14	9.2	6.8	6.6	21	19	29	6.8	8.6	6.4	7.2	8.4
15	7.0	11	6.6	11	18	30	18	13	6.4	6.4	6.9
						31	7.0	.....	6.4	.....	7.2

NOTE.—Daily discharge computed from a rating curve that is fairly well defined between 6 and 12 second-feet.

Monthly discharge of Honokawai Stream near Lahaina, Maui, for Aug. 1 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August	18	6.5	9.56	588	C.
September	26	6.6	11.0	655	C.
October	12	6.4	7.49	461	B.
November	21	6.4	9.05	539	C.
December	21	6.2	8.98	552	C.

HONOKAWAI STREAM AT WEIR NO. 1, NEAR LAHAINA, MAUI.

The Pioneer Mill Co. installed a small weir on the main stream above all diversions in December, 1901. The record, which was kept only a few weeks, has been furnished the Geological Survey by the Pioneer Mill Co.

Daily discharge, in second feet, of Honokawai Stream at weir No. 1, near Lahaina, Maui, for 1901.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1	5.5	7.1	11	5.7	9.4	21	6.3	6.1
2	5.5	6.0	12	5.4		22	6.0	6.1
3	5.5	6.1	13	10		23	8.8	6.1
4	5.4	5.7	14	10		24	5.8	6.1
5	5.4	5.8	15	6.4		25	5.5	
6	5.4	9.5	16	5.6		26	5.5	
7	5.4	(a)	17	10		27	5.5	
8	5.4	(a)	18	9.0		28	5.6	
9	5.4	7.1	19	6.1		29	6.6	
10	6.0	11	20	9.2		30	6.2	
						31	7.6	

a High water. No readings.

NOTE.—Daily discharge computed by the Geological Survey from records furnished by the Pioneer Mill Co.

HONOLUA STREAM BASIN.

GENERAL FEATURES.

Honolua basin lies on the northwestern slope of West Maui. The basin extends well back toward the summit of Puu Kukui, its upper part lying between Honokawai basin at the west and Honokahau at the east. Water is diverted into Honokahau ditch at 700 feet elevation.

HONOLUA STREAM NEAR HONOKAHAU, MAUI.

A gaging station was established on Honolua Stream below the intake of Honolua ditch August 7, 1911. The gage is fastened to one of the piers of the Honokahau ditch bridge, which crosses the stream about one-fourth of a mile below the intake of Honolua ditch. The gage is for flood readings only. No discharge measurements have been made.

Daily gage height, in feet, of Honolua Stream near Honokahau, Maui, for 1911.

[R. C. Searle, jr., observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1			1.1			16	1.0				
2			.35			17	1.15	0.4			
3			.2			18	.65	1.2			
4			.2			19	.9	.65			0.8
5						20		1.55			
6			.35			21		1.25			
7			.95		1.3	22		.9		0.6	
8		1.2	.4			23		1.6		.4	
9						24		1.0		.2	
10		.7				25	.4	.25			
11		1.45				26	.5	1.7			
12	0.5	.9				27		1.15			
13	.8			1.2		28		1.35		1.1	
14				1.1	.3	29	1.4	.55			
15				.25	.8	30	1.75	1.7			
						31					

NOTE.—From Aug. 7 to Dec. 31, where no gage heights appear, stream was dry.

HONOLUA DITCH NEAR HONOKAHAU, MAUI.

A staff gage was set in a flume of the Honolua ditch, about 150 feet below the intake, August 7, 1911. The gage is on the left side of the flume, which crosses the Honolua Stream.

Only one discharge measurement has been made at this place.

Discharge measurements of Honolua ditch near Honokahau, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 7	J. B. Stewart	4.0	2.0	0.49	2.30

Daily gage height, in feet, of Honolua ditch near Honokahau, Maui, for 1911.

[R. C. Searle, jr., observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.56	0.80	0.42	0.47	16	0.88	0.73	0.58	0.53	0.73
2	.....	.55	.85	.42	.43	17	1.08	.90	.66	.74	.80
3	.....	56	.90	.42	.40	18	.86	.62	.62	.56	.81
4	.....	.79	.90	.40	.40	19	1.02	.90	.57	.49	.90
5	.....	.64	.88	.40	.45	20	.71	.90	.54	.48	.66
6	.....	.52	.88	.42	.60	21	.56	.90	.53	.80	.54
7	0.48	.66	.90	.40	.50	22	.49	.90	.53	.80	.50
8	.46	.90	.90	.60	.80	23	.46	.90	.51	.85	.46
9	.57	.69	.83	.50	.64	24	.65	.90	.50	.87	.45
10	.64	.70	.76	.46	.45	25	.87	.90	.50	.86	.48
11	.51	.85	.68	.44	.44	26	.82	.90	.50	.45	.43
12	.78	.85	.62	.42	.42	27	.55	.90	.48	.43	.42
13	.84	.72	.61	.66	.59	28	.52	.90	.46	.90	.58
14	.72	.62	.60	.88	.73	29	.72	.90	.44	.78	.74
15	.54	.56	.58	1.25	.78	30	.98	.80	.43	.55	.50
						31	.67	.....	.42	.....	.50

HONOKAHAU STREAM BASIN.

GENERAL FEATURES.

Honokahau basin, which lies on the northern slope of West Maui, is from 1 to 1½ miles wide and about 9 miles long, reaching back to the summit of Puu Kukui, where it adjoins Waihee basin at the east, Iao basin at the south, and Honokawai basin at the west.

The rainfall at elevation 806 feet averages about 145 inches. In the upper part of the basin the rainfall is probably very heavy.

Water is diverted at elevation 806 feet into Honokahau ditch for cane irrigation and through smaller ditches in the lower part of the basin for taro irrigation.

HONOKAHAU STREAM NEAR HONOKAHAU, MAUI.

A gaging station was established on Honokahau Stream at the intake of Honokahau ditch August 13, 1911. The gage is fastened to the end of the diversion dam on the left side of the stream, its zero being 1.07 feet below the crest of the dam. This gage is used for flood readings only.

The dam has been used as a weir for computing the flow from the gage heights on the dam. The discharge does not include the water taken by Honokahau ditch.

Daily discharge, in second-feet, of Honokahau Stream near Honokahau, Maui, for 1911.

Day.	Aug.	Sept.	Nov.	Dec.	Day.	Aug.	Sept.	Nov.	Dec.
1		0.0	0.0	0.0	16	406	3.8	26	3.8
2		.0	.0	.0	17	239	95	44	3.8
3		11	.0	.0	18	76	116	3.8	16
4		20	.0	.0	19	162	59	.0	52
5		.0	11	.0	20	0	127	7.4	.0
6		.0	.0	11	21	0	116	16	1.9
7		20	.0	16	22	0	44	138	.0
8		44	38	26	23	0	138	11	.0
9		16	3.8	.0	24	44	86	31	.0
10		38	.0	.0	25	76	59	.0	.0
11		187	.0	.0	26	59	267	.0	.0
12		16	.0	.0	27	0	68	138	20
13	31	.0	116	1.9	28	0	106	44	38
14	59	.0	116	68	29	187	44	3.8	3.8
15	76	7.4	95	59	30	59	267	.0	7.4
					31	0			.0

NOTE.—Daily discharge computed from weir formula. No discharge measurements have been made at this station. No record was obtained for the month of October.

Monthly discharge of Honokahau Stream near Honokahau, Maui, for Aug. 18 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August 13–31	406	0.0	77.6	2,920	D.
September	267	.0	65.2	3,880	D.
November	138	.0	28.1	1,670	D.
December	68	.0	10.6	652	D.

NOTE.—Record for month of October missing.

HONOKAHAU DITCH AT INTAKE, NEAR HONOKAHAU, MAUI.

Gage height records on Honokahau ditch just below the intake have been kept by the Honolua Ranch Co. since the opening of the ditch early in 1907. Current-meter measurements have been made for rating the section.

Daily gage heights from February 3, 1907, up to the end of 1911, have been furnished the Geological Survey by the Honolua Ranch Co. The discharge at this station shows the total quantity of water taken from Honokahau Stream.

Discharge measurements of Honokahau ditch at intake, near Honokahau, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Inches.*	*Sec.-ft.*
July 18	Martin and Stewart	7.8	17.0	30	34.9

NOTE.—In the early part of 1912 additional measurements were made at this station from which a well defined rating curve was obtained.

Daily discharge, in second-feet, of Honokahau ditch at intake, near Honokahau, Maui, for 1907–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	29	29	25	22	36	31	39	37	43	38
2	.....	.....	28	27	25	22	43	37	37	43	43	29
3	.....	43	43	31	25	21	39	27	35	36	41	29
4	.....	33	43	33	23	43	23	43	39	39	43	29
5	.....	29	43	33	23	27	26	37	39	41	36	29
6	.....	28	33	37	35	39	25	25	39	39	38	29
7	.....	29	40	35	25	43	24	43	39	35	33	29
8	.....	35	39	37	27	36	22	37	38	33	39	29
9	.....	37	33	29	34	30	36	43	39	43	35	28
10	.....	29	27	35	41	43	33	43	43	43	32	28
11	.....	43	27	38	33	39	23	43	43	43	31	27
12	.....	39	27	43	27	36	32	35	41	35	31	27
13	.....	31	25	33	25	24	23	27	36	39	31	37
14	.....	29	25	29	31	41	29	37	35	41	29	34
15	.....	29	34	39	24	35	22	43	35	35	43	33
16	.....	33	43	32	23	43	23	43	33	39	33	29
17	.....	39	38	27	26	27	21	41	33	43	31	33
18	.....	32	31	25	23	33	33	41	33	43	35	29
19	.....	33	35	34	34	27	36	43	38	41	31	25
20	.....	29	39	43	23	22	33	43	37	39	43	29
21	.....	31	43	31	22	22	43	35	38	39	43	27
22	.....	27	42	27	22	32	43	43	43	43	43	27
23	.....	29	39	26	23	22	27	43	43	43	38	31
24	.....	31	33	31	22	31	43	41	43	41	43	41
25	.....	29	31	37	22	35	43	42	43	39	43	27
26	.....	42	43	35	22	28	37	43	39	41	43	29
27	.....	39	37	27	22	33	43	43	43	43	43	43
28	.....	40	35	25	21	37	37	43	43	43	37	37
29	.....	.....	29	30	31	37	35	43	41	37	41	39
30	.....	.....	41	27	35	31	33	39	37	35	33	37
31	.....	.....	31	.....	27	.....	25	41	.....	41	.....	30
1908.												
1	43	42	22	20	20	29	21	26	43	33	22	43
2	39	33	22	22	18	20	31	43	43	26	22	37
3	30	35	23	23	19	20	27	37	39	31	22	27
4	28	41	22	25	35	18	43	24	37	29	33	31
5	29	33	33	27	23	29	40	29	37	35	43	25
6	29	43	25	28	31	33	26	26	43	29	31	33
7	25	41	22	31	37	31	22	43	31	31	35	40
8	25	41	22	27	39	23	27	43	27	27	35	31
9	25	43	22	34	27	20	31	43	27	27	33	43
10	25	43	20	35	25	22	48	27	33	25	31	33
11	24	35	20	43	21	33	22	22	43	24	28	25
12	24	29	20	43	43	22	26	33	43	26	25	23
13	23	27	20	34	25	20	23	43	39	27	23	23
14	23	25	31	33	31	22	22	43	41	25	21	23
15	41	25	27	43	33	43	31	37	35	41	21	22
16	35	27	39	26	24	29	20	37	37	27	21	22
17	37	25	23	23	31	22	19	32	29	27	35	23
18	27	25	22	27	21	33	22	23	37	31	25	29
19	25	23	31	26	35	43	20	22	43	37	31	43
20	29	25	24	32	20	29	39	22	41	43	37	43
21	26	23	22	45	31	39	35	21	31	41	33	39
22	24	23	21	22	33	36	31	21	31	36	27	27
23	23	22	20	19	39	43	21	22	39	43	22	37
24	23	22	21	20	35	43	21	43	29	41	35	41
25	23	22	20	19	34	35	28	43	28	29	43	43
26	23	22	22	19	25	35	33	43	26	25	39	43
27	23	22	22	18	35	25	43	39	26	25	37	43
28	23	22	20	19	23	20	43	27	28	23	41	43
29	27	22	20	23	35	18	26	33	29	23	33	41
30	31	.....	20	31	23	23	33	43	37	24	37	39
31	29	.....	19	.....	22	.....	37	43	.....	23	.....	29

Daily discharge, in second-feet, of Honokahau ditch at intake, near Honokahau, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	27	43	43	41	43	35	43	40	38	30	33	22
2	27	31	43	43	43	35	43	41	33	35	31	22
3	25	26	36	43	43	35	41	39	32	40	39	26
4	23	35	43	43	43	39	35	39	31	31	38	23
5	23	25	35	41	43	38	35	38	31	33	28	22
6	22	33	30	39	39	39	39	35	30	38	27	22
7	22	35	39	43	43	43	43	37	30	29	25	22
8	22	30	25	43	43	37	43	41	41	29	43	21
9	22	23	23	39	43	41	42	37	36	28	30	21
10	22	22	32	43	43	35	42	37	31	27	35	20
11	22	22	12	37	43	34	37	35	35	27	32	20
12	22	31	0	39	43	39	42	39	33	43	33	21
13	22	35	0	37	12	37	43	35	36	43	43	21
14	22	23	0	37	43	43	43	37	38	30	37	21
15	21	22	43	35	43	43	43	40	31	29	27	21
16	21	23	43	35	41	41	43	35	37	37	25	22
17	21	33	31	35	41	41	43	39	35	28	25	38
18	21	43	36	34	41	41	43	35	37	27	23	39
19	21	35	43	34	43	41	43	41	37	30	23	39
20	21	27	43	33	38	43	43	43	9	28	23	87
21	22	23	43	35	35	41	43	37	29	43	23	37
22	22	31	43	43	41	41	43	43	29	30	23	43
23	37	28	41	41	37	35	38	41	43	43	23	43
24	43	39	43	35	34	37	36	42	43	33	23	43
25	27	41	43	35	33	43	43	41	37	29	33	38
26	35	39	43	33	41	39	43	35	31	33	29	43
27	29	39	43	35	43	39	43	33	43	29	23	34
28	36	43	41	41	11	39	43	35	43	27	23	27
29	41	.....	43	39	43	35	43	35	41	27	22	35
30	43	.....	42	37	39	43	43	37	34	29	22	32
31	41	.....	43	.....	36	.....	39	39	.....	37	.....	25
1910.												
1	23	43	28	43	29	40	32	32	33	40	27	43
2	23	41	37	43	43	43	31	31	33	43	27	43
3	23	37	43	42	37	39	38	43	39	43	30	43
4	33	39	43	33	43	35	43	43	40	41	30	43
5	43	41	43	28	36	43	41	42	39	38	28	43
6	40	30	39	27	37	35	41	43	41	41	27	43
7	31	27	39	34	43	43	43	39	38	43	29	43
8	26	25	29	43	33	42	32	35	34	43	31	43
9	25	24	27	35	37	39	31	43	33	42	27	39
10	33	23	25	28	35	39	29	35	32	40	35	38
11	37	33	25	27	29	43	37	36	32	35	35	35
12	43	38	25	27	27	39	39	39	31	37	27	33
13	43	35	24	25	25	43	29	43	31	36	27	33
14	39	27	25	24	33	39	34	43	31	31	26	32
15	35	25	23	26	35	43	43	39	31	31	25	31
16	43	24	23	25	43	39	43	35	31	31	25	31
17	43	24	23	37	33	37	43	30	34	29	43	31
18	43	23	23	39	36	39	39	29	31	29	42	31
19	40	26	35	29	38	29	41	29	31	29	37	31
20	39	23	43	38	33	35	37	43	30	29	29	31
21	43	23	39	34	25	43	31	43	32	29	37	30
22	43	39	37	28	24	39	29	43	31	37	27	41
23	43	35	42	39	26	41	32	43	39	39	33	33
24	37	27	41	42	27	33	29	41	42	35	43	43
25	33	24	43	43	26	34	40	43	39	29	29	43
26	31	23	41	43	23	31	37	41	37	29	31	42
27	43	27	39	37	23	35	41	43	34	28	37	42
28	37	27	43	31	23	28	33	42	37	31	43	35
29	29	.....	42	27	23	37	29	36	42	30	43	36
30	38	.....	36	0	25	35	35	34	43	27	43	43
31	42	.....	43	.....	43	.....	39	34	.....	27	.....	43

Daily discharge, in second-feet, of Honokahau ditch at intake, near Honokahau, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	37	41	42	37	39	39	41	41	35	43	37	34
2	37	43	39	35	43	43	43	41	39	43	37	33
3	33	43	39	40	39	43	43	41	37	43	36	33
4	43	43	38	33	34	43	43	41	43	43	36	31
5	43	43	37	31	37	43	43	38	39	43	39	33
6	43	43	37	31	41	43	43	34	35	43	41	43
7	38	43	37	31	35	43	43	35	43	43	37	37
8	33	43	37	32	33	43	43	35	43	43	41	43
9	32	43	37	31	43	43	43	43	42	43	43	35
10	39	43	43	31	43	43	43	39	43	43	37	34
11	42	43	38	37	42	42	43	39	43	43	37	37
12	43	42	37	39	42	42	43	42	43	42	35	34
13	43	41	35	39	43	43	43	43	41	42	41	39
14	37	41	35	31	43	43	43	41	38	41	43	43
15	34	40	35	31	43	42	43	39	43	41	43	43
16	33	39	35	37	43	43	43	43	39	40	37	42
17	38	39	36	43	37	43	40	43	41	43	43	43
18	37	38	35	43	39	43	39	43	43	41	40	43
19	43	38	39	43	35	43	37	43	40	40	41	43
20	37	37	39	43	41	43	43	41	43	39	39	35
21	36	37	37	43	43	43	40	36	43	39	43	38
22	33	37	37	43	43	43	39	35	43	39	41	33
23	31	37	35	42	41	43	39	35	43	39	43	31
24	43	41	37	43	35	43	38	40	43	39	43	33
25	43	43	43	43	33	43	35	43	43	39	38	33
26	43	42	39	43	31	43	35	43	43	41	35	30
27	43	43	37	43	41	43	35	38	43	39	35	29
28	43	43	39	43	34	43	34	35	43	37	43	35
29	41	.....	37	35	43	43	33	39	43	37	41	43
30	37	.....	40	39	43	41	33	12	43	37	35	38
31	43	.....	41	.....	43	.....	33	11	.....	37	.....	38

NOTE.—Daily discharge computed from a rating curve that is well defined below 40 second-feet.

Monthly discharge of Honokahau ditch at intake, near Honokahau, Maui, for 1907–1911

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
February 3–28	43	27	33.4	1,720
March	43	25	35.0	2,150
April	43	25	32.2	1,920
May	41	21	26.5	1,630
June	43	21	32.0	1,900
July	43	21	32.0	1,970
August	43	25	39.3	2,420
September	43	33	38.8	2,310
October	43	33	39.8	2,450
November	43	31	37.6	2,240
December	43	27	31.2	1,920
The period	43	21	34.3	22,600
1908.				
January	43	23	27.8	1,710
February	43	22	29.7	1,710
March	39	19	23.1	1,420
April	45	18	27.9	1,660
May	43	18	28.8	1,770
June	43	18	28.6	1,700
July	48	19	29.4	1,810
August	43	21	33.3	2,050
September	43	26	35.1	2,090
October	43	23	30.1	1,850
November	43	21	30.7	1,830
December	43	22	33.7	2,070
The year	48	18	29.9	21,700

Monthly discharge of Honokahau ditch at intake, near Honokahau, Maui, for 1907–11— Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1909.				
January	43	21	26.6	1,640
February	43	22	31.4	1,740
March	43	0	34.5	2,120
April	43	33	38.3	2,280
May	43	11	38.9	2,390
June	43	34	39.1	2,330
July	43	35	41.5	2,550
August	43	33	38.1	2,340
September	43	9	34.5	2,050
October	43	27	32.3	1,990
November	43	22	28.8	1,710
December	43	20	28.8	1,770
The year	43	0	34.4	24,900
1910.				
January	43	23	36.3	2,230
February	43	23	29.8	1,660
March	43	23	34.5	2,120
April	43	0	32.6	1,940
May	43	23	32.0	1,970
June	43	28	38.0	2,260
July	43	29	36.2	2,230
August	43	29	38.5	2,370
September	43	30	35.0	2,080
October	43	27	34.6	2,130
November	43	25	32.4	1,930
December	43	30	39.2	2,410
The year	43	0	35.0	25,300
1911.				
January	43	31	38.7	2,380
February	43	37	41.0	2,280
March	43	35	37.8	2,320
April	43	31	37.8	2,250
May	43	31	39.5	2,430
June	43	39	42.7	2,540
July	43	33	40.0	2,460
August	43	11	37.8	2,320
September	43	35	41.4	2,460
October	43	37	40.8	2,510
November	43	35	39.3	2,340
December	43	29	36.7	2,260
The year	43	11	39.5	28,600

HONOKAHAU DITCH ABOVE HONOLUA STREAM, NEAR HONOKAHAU, MAUI.

The Honolua Ranch Co. has kept a record of daily gage height on the Honokahau ditch in the flume just above the inflow from Honolua Stream and has furnished the data to the Geological Survey for 1910 and 1911. Current-meter measurements have been made for rating the section.

Discharge measurements of Honokahau ditch above Honolua Stream, near Honokahau, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Inches.*	*Sec.-ft.*
July 18	Martin and Stewart	3.9	8.7	.....	29.8
Dec. 29	J. B. Stewart	4.0	10.2	31	34.5

NOTE.—In the early part of 1912 additional measurements were made at this station from which a well-defined rating curve was obtained.

Daily discharge, in second-feet, of Honokahau ditch, above Honolua Stream, near Honokahau, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	17	36	20	36	22	34	27	26	27	34	23	36
2	16	33	30	35	31	35	25	25	27	36	22	36
3	16	30	36	35	30	33	29	36	34	36	24	36
4	22	30	36	26	36	26	36	36	34	35	24	36
5	24	33	36	22	26	36	34	36	32	32	23	36
6	31	23	32	20	32	30	34	36	34	32	22	36
7	24	21	36	26	36	33	36	32	32	36	22	36
8	19	19	22	35	28	34	27	27	28	36	24	36
9	8	18	20	27	33	31	26	36	26	32	22	33
10	22	17	19	23	28	32	24	30	26	34	26	31
11	26	28	19	21	23	32	28	32	26	28	30	29
12	36	30	19	22	22	32	34	32	26	32	23	28
13	35	28	18	19	20	36	24	36	26	30	22	26
14	32	20	19	18	22	28	26	36	25	26	22	26
15	29	18	18	19	26	36	11	33	25	25	22	26
16	32	5.3	18	19	30	33	36	29	25	25	21	25
17	33	17	18	28	26	30	36	26	28	24	36	25
18	32	17	18	30	29	33	32	24	26	24	33	24
19	31	18	26	24	31	24	35	24	25	24	30	25
20	32	17	35	24	28	30	32	36	24	24	23	25
21	30	17	33	26	22	36	25	36	24	26	28	24
22	34	30	30	23	20	32	23	36	25	30	23	33
23	34	20	34	27	21	34	26	36	30	32	26	27
24	27	20	32	36	23	26	23	35	34	28	35	36
25	23	18	32	36	22	28	32	36	30	24	23	36
26	22	17	32	37	20	24	28	34	30	23	24	36
27	34	20	30	30	19	28	32	36	28	23	24	36
28	28	20	30	26	18	23	28	36	30	25	36	31
29	21	.....	30	22	18	50	23	30	34	25	36	32
30	28	.....	27	0	20	26	28	28	36	23	36	36
31	33	.....	34	.....	36	.....	33	28	.....	23	.....	36
1911.												
1	32	34	36	30	34	34	35	32	30	36	30	28
2	31	36	34	28	36	36	36	34	31	36	30	26
3	27	36	32	32	34	36	36	33	30	36	29	26
4	36	36	32	26	29	36	36	32	36	36	28	26
5	36	36	30	25	30	36	36	30	32	36	30	26
6	36	36	30	24	35	36	36	28	28	36	32	33
7	33	36	30	24	29	36	36	28	35	36	30	30
8	28	36	30	24	20	36	36	28	36	36	33	36
9	26	11	30	24	35	36	35	34	35	36	34	30
10	32	36	34	23	36	36	36	32	34	36	30	28
11	36	36	30	26	36	36	36	30	36	36	29	28
12	36	36	28	31	35	36	36	34	36	34	28	27
13	36	36	28	26	36	36	36	36	34	34	32	31
14	32	35	28	24	36	36	36	34	32	34	36	35
15	27	34	27	24	36	36	36	30	34	34	11	36
16	27	34	27	26	36	36	36	36	32	34	32	36
17	32	32	28	36	31	36	34	36	35	36	36	36
18	33	32	28	36	32	36	31	36	36	34	34	36
19	36	32	30	36	29	36	32	34	33	34	34	36
20	32	32	32	36	36	36	22	34	36	32	32	32
21	30	30	28	36	36	36	33	30	36	32	36	30
22	26	30	30	36	36	36	32	28	36	32	34	28
23	26	30	27	36	34	36	32	28	36	32	36	26
24	34	34	28	36	27	35	30	32	36	30	36	26
25	36	36	34	36	25	36	28	36	36	31	32	28
26	36	34	30	36	28	36	28	36	36	32	28	25
27	36	36	28	36	30	36	28	31	36	30	28	24
28	36	36	31	35	26	36	26	29	36	30	36	30
29	36	.....	30	30	36	36	26	32	36	30	34	35
30	32	.....	32	33	36	35	26	11	36	30	30	28
31	35	.....	34	.....	36	.....	26	9.5	.....	30	.....	28

NOTE.—Daily discharge computed from a rating curve that is well defined between 15 and 40 second-feet.

Monthly discharge of Honokahau ditch above Honolua Stream, near Honokahau, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	36	8	26.8	1,650
February	36	5.3	22.2	1,230
March	36	18	27.1	1,670
April	36	0	25.7	1,530
May	36	18	25.7	1,580
June	36	23	30.8	1,830
July	36	11	28.8	1,770
August	36	24	32.2	1,980
September	36	24	28.6	1,700
October	36	23	28.6	1,760
November	36	21	26.2	1,560
December	36	24	31.4	1,930
The year	36	0	27.9	20,200
1911.				
January	36	26	32.5	2,000
February	36	11	33.5	1,860
March	36	27	30.2	1,860
April	36	24	30.4	1,810
May	36	20	32.6	2,000
June	36	34	35.9	2,140
July	36	26	32.5	2,000
August	36	9.5	30.8	1,890
September	36	28	34.4	2,050
October	36	30	33.6	2,070
November	36	11	31.3	1,860
December	36	24	30.0	1,840
The year	36	9.5	32.3	23,400

HONOKAHAU DITCH AT HONOKAWAI WEIR, NEAR LAHAINA, MAUI.

The water in the Honokahau ditch is measured by an 8-foot weir on the north side of Honokawai Gulch, a clock register being used for recording the gage heights. The records at this weir for 1910–11 have been furnished to the Geological Survey by the Honolua Ranch Co.

Discharge measurements of Honokahau ditch at Honokawai weir, near Lahaina, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 17	Martin and Stewart	8.0	13.5	[a] 1.02	26.3

[a] Gage height is the head on 8-foot weir.

Daily discharge, in second-feet, of Honokahau ditch at Honokawai weir, near Lahaina, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	21	32	23	33	19	32	26	27	26	31	19	31
2	19	31	28	32	25	32	25	24	25	31	19	32
3	18	29	25	33	27	32	28	27	27	31	20	32
4	21	29	33	29	27	28	31	32	29	31	21	32
5	33	31	31	25	27	32	31	32	28	29	21	31
6	32	27	31	23	29	30	30	30	29	29	20	32
7	29	23	32	27	32	29	31	32	28	29	20	31
8	24	22	27	30	29	31	28	27	26	30	23	31
9	19	21	22	30	29	31	26	30	24	30	20	30
10	19	20	21	24	27	31	24	29	24	29	20	29
11	25	28	20	23	25	29	25	28	24	26	28	32
12	32	33	20	23	23	29	29	28	23	26	25	26
13	26	31	19	21	21	31	25	31	23	7.5	22	25
14	32	25	20	20	20	28	24	31	23	24	19	24
15	32	23	19	19	23	31	25	30	23	23	19	24
16	31	10	19	20	28	30	32	28	23	23	25	24
17	30	21	19	25	27	28	31	25	25	22	27	23
18	29	20	18	30	27	31	31	24	24	22	25	23
19	31	22	24	26	29	26	30	24	23	22	21	22
20	31	20	31	26	27	27	30	28	8.0	22	21	23
21	28	19	30	27	22	31	24	18	22	22	21	22
22	32	28	27	23	20	30	24	30	23	25	16	26
23	32	22	28	25	23	31	24	31	25	28	17	24
24	17	24	31	30	24	27	24	30	.8	25	23	29
25	25	20	15	30	20	27	27	31	27	23	21	31
26	23	19	31	32	20	25	25	31	27	21	22	32
27	28	21	31	29	19	27	28	32	27	21	27	32
28	30	21	30	26	19	24	27	31	24	21	27	32
29	24	.....	30	23	19	26	24	29	29	22	30	30
30	27	.....	29	21	19	27	23	28	27	21	30	29
31	31	.....	29	.....	31	.....	28	27	.....	20	.....	32
1911.												
1	29	30	32	26	30	30	29	25	29	30	24	24
2	28	32	30	26	29	32	29	27	27	31	24	23
3	25	32	29	27	30	31	29	26	28	30	24	22
4	28	32	28	25	25	32	30	26	29	30	24	22
5	29	32	27	23	26	32	29	27	29	30	24	22
6	31	32	27	22	29	32	30	24	25	29	24	24
7	29	32	27	22	27	32	30	24	28	31	24	24
8	26	32	26	22	24	32	29	24	29	31	25	29
9	24	27	26	22	29	32	29	25	29	30	25	25
10	27	31	28	21	32	32	28	27	27	29	25	24
11	29	32	27	22	29	31	30	25	31	28	24	24
12	31	33	25	25	29	30	31	28	31	27	23	24
13	31	33	25	25	27	32	31	29	30	27	26	25
14	31	32	25	23	31	32	31	28	27	29	28	26
15	27	32	25	22	31	31	29	27	27	27	31	29
16	24	31	25	22	31	31	31	29	27	26	27	29
17	27	31	25	30	29	31	29	31	28	28	29	28
18	32	30	25	31	29	30	27	31	30	27	29	28
19	32	29	24	30	27	30	27	31	28	26	29	28
20	29	29	25	32	30	30	14	30	31	26	27	27
21	25	29	27	32	30	31	27	26	20	25	29	25
22	24	28	25	31	32	31	27	25	31	25	28	25
23	26	28	25	32	32	30	27	24	32	25	30	22
24	31	29	25	32	28	29	25	26	32	25	29	22
25	32	32	25	32	26	29	25	29	31	25	28	24
26	31	30	28	32	29	29	25	30	32	25	25	21
27	32	33	27	31	26	30	24	27	32	25	24	21
28	32	32	25	31	25	31	24	25	32	25	29	25
29	29	.....	27	28	32	30	24	27	31	24	29	27
30	29	.....	30	31	32	28	23	29	31	25	26	24
31	29	.....	29	.....	32	.....	23	17	.....	24	.....	26

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of head on an 8-foot weir furnished by the Honolua Ranch Co.

Monthly discharge of Honokahau ditch at Honokawai weir, near Lahaina, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	33	17	26.8	1,650
February	32	10	24.0	1,330
March	33	15	25.6	1,570
April	33	19	26.2	1,560
May	32	19	24.4	1,500
June	32	24	29.1	1,730
July	32	23	27.1	1,670
August	32	18	28.5	1,750
September	29	.8	23.9	1,420
October	31	7.5	24.7	1,520
November	30	16	22.3	1,330
December	32	21	28.3	1,740
The year	33	0.8	25.9	18,800
1911.				
January	32	24	28.7	1,760
February	33	27	30.9	1,720
March	32	24	26.6	1,640
April	32	21	27.0	1,610
May	32	24	29.0	1,780
June	32	28	30.8	1,830
July	31	23	27.3	1,680
August	31	17	26.7	1,640
September	32	20	29.1	1,730
October	31	24	27.2	1,670
November	31	23	26.4	1,570
December	29	21	24.8	1,520
The year	33	17	27.9	20,200

MISCELLANEOUS MEASUREMENTS ON WEST MAUI.

The following miscellaneous measurements have been made on West Maui. Measurements of the streams, ditches, and development tunnels are arranged in clockwise order, beginning at the Waihee Stream on the northeast. Some measurements have been made of water coming from the ditches of various pumping plants.

Miscellaneous measurements on streams and ditches in West Maui in 1910–11.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
1910. Dec. 29	Waihee Stream	Pacific Ocean	Gage above intake of Waihee canal, near Waihee.	2.15	72
1911. Aug. 22	do	do	do	2.15	68
24	South Waiehu Stream.	North Waiehu Stream.	Gage at T. Burlem's house, near Wailuku.	.60	.27
1910. Feb. 17	Iao Stream	Pacific Ocean	Above gaging station near Wailuku.	.....	35.0
Apr. 28	do	do	do	.....	49.4
29	do	do	Below gaging station near Wailuku.	.....	56.0
29	Culvert Creek	Iao Stream	Mouth, below Iao gaging station near Wailuku.	.....	1.85
Nov. 12	Waikapu Stream	Pacific Ocean	Above South Side ditch intake near Waikapu.	*a*.63	5.8
17	do	do	do	*a*.65	7.8
1911. Aug. 23	do	do	do	*a*.70	8.1
July 20	Kauaula Stream	do	1,000 feet above Piilani ditch near Lahaina.	.....	12.4
Aug. 4	Honokawai Stream	do	Below junction with Amalu stream, near Kaanapali.	.....	.16

a Regular station about 1 mile below.

Miscellaneous measurements on streams and ditches in West Maui in 1910–11—Con.

Date.	Stream or ditch.	Tributary to or diversion from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
1911. Oct. 17	Amalu Stream	Honokawai Stream.	Above ditch intake, just above junction with Honokawai Stream, near Lahaina.	1.90	2.07
1910. Nov. 7	Waihee canal	Waihee Stream	Near second tunnel below intake near Waihee.		53
9	do	do	do		55
1911. Jan. 27	do	do	do		52
Aug. 22	do	do	do		50
22	do	do	10 feet above chute to Spreckels's ditch near Waihee.		50
1910. Nov. 7	do	do	20 feet below chute to Spreckels's ditch near Waihee.		29.9
1911. Aug. 22	do	do	do		26.5
22	do	do	At flume in Wailuku Sugar Co.'s field No. 38 near Waihee.		49.1
1910. Dec. 26	do	do	Siphon crossing Iao Stream near Wailuku.		45.4
Nov. 9	Native ditch (south side).	do	Bridge below ditchman's house near Waihee.	.79	5.6
1911. Jan. 27	do	do	do	1.14	14.9
1910. Nov. 9	Kapuna ditch (north side).	do	Near intake above Waihee	.81	2.5
Dec. 26	Kalana Auwai (north side).	Iao Stream	Near intake above Wailuku	.25	2.9
26	Waldbrige ditch (south side).	do	do	.38	4.6
Nov. 14	Kama Auwai (south side).	do	Near intake above Wailuku	.47	1.16
Dec. 27	do	do	do	1.60	22.4
27	do	do	do	1.70	24.4
1911. Jan. 4	do	do	do	1.90	27.7
1910. Dec. 26	Third ditch (north side).	do	do	.42	3.07
Nov. 11	Palama ditch	Waikapu Stream	do	.55	2.71
1911. July 25	Launiupoko ditch	Launiupoko Stream.	Reservoir near Lahaina		1.20
20	Piilani ditch	Kauaula Stream	500 feet above weir near Lahaina.	[a].65	9.8
Oct. 16	Kauaula ditch	do	Near Lahaina	.21	0.9
18	Lahainaluna ditch	Lahainaluna Stream.	Below tail-water from power house at Lahainaluna School.		2.0
Aug. 2	Lahaina waterworks ditch.	do	Intake about 1 mile above Lahainaluna School, near Lahaina.		5.1
2	do	do	Filtering station above Lahainaluna School, near Lahaina.	[b]4.01	1.04
3	Old Kahoma ditch	Kahoma Stream	Flume below weir tunnel entrance near Lahaina.		4.6
July 23	do	do	do		7.0
23	do	do	Reservoir near Lahaina		6.1
26	Honokawai ditch	Honokawai Stream.	Below Honokawai power house.	[a].58	8.1
18	Honokahau ditch	Honokahau Stream.	Flume No. 4 near Honokahau		31.2
17	do	Honokahau and Honolua streams.	Just below Honolua Stream, near Honokahau.	2.50	36.7
17	do	do	Makupea flume near Honokahau.	[c].65	33.4
17	do	do	Waiaolali near Honokahau	2.31	31.6
17	do	do	Napili flume near Honokahau.	[d].68	30.7
17	do	do	Aloeloa flume near Honokahau.		29.5

[a] Head over 5-foot weir.
[b] Distance to water surface from reference mark on board, 30 feet above filtering station.
[c] Distance from mauka edge of flume, opposite nail, to water surface.
[d] Distance from top of mauka side of Napili flume to water surface.

Miscellaneous measurements of development tunnels in West Maui in 1911.

Date.	Tunnel.	Tributary to—	Locality.	Discharge.
1911.				*Sec.-ft.*
Aug. 21	Upper Waihee	Waihee Stream	Several miles above all ditches and above Waihee.	0.59
21	Lower Waihee	do	do	8.0
25	Iao No. 1 (north)	Iao Stream	Above "The Needle," in Iao Valley, near Wailuku.	.96
25	Iao No. 2 (south)	do	do	.62
23	Waikapu No. 1	Waikapu Stream	Several miles above reservoir near Waikapu.	2.7
July 25	Launiupoko	Launiupoko Stream	½ mile above upper ditch intake near Lahaina.	.28
26	Upper Honokawai	Honokawai Stream	½ mile above upper Honokawai ditch near Kaanapali.	5.7
26	Lower Honokawai	do	At upper Honokawai tunnel near Kaanapali.	1.53

NOTE.—Water intercepted by tunnels driven into the sides of gulches.

Miscellaneous measurements of pumping plants in West Maui in 1911.

Date.	Pump.	Locality.	Discharge.
1911.			*Sec.-ft.*
Aug. 14	Byron & Jackson centrifugal pump.	Pump house near Olowalu	2.35
July 20	Doble centrifugal pump	Pipe outlet into ditch at Lahaina	14.9
Oct. 19	do	do	12.5
19	do	do	12.8
July 20	Pump	Lahaina	22.2
21	do	do	25.2

PUMPED WATER ON WEST MAUI.

Considerable water is pumped for irrigation on the lee side of West Maui by the Olowalu Sugar Co. and the Pioneer Mill Co. The Olowalu Sugar Co. pumps on an average only about 666,000 gallons daily. The Pioneer Mill Co., however, pumps on an average about 26.4 million gallons daily.

Figures showing the amount of water pumped each month by the Pioneer Mill Co. have been furnished to the Geological Survey. Both steam and electric pumps are used.

Monthly summary of water pumped by the Pioneer Mill Co. at Lahaina, Maui, for January to November, 1911.

Month.	Mean quantity pumped daily.		Total quantity pumped.	
	Million gallons.	Second-feet.	Million gallons.	Acre-feet.
January	3.71	5.75	115	353
February	10.0	15.5	281	863
March	8.29	12.8	257	790
April	7.03	10.9	211	648
May	26.5	41.1	820	2,515
June	34.7	53.8	1,040	3,190
July	39.7	61.5	1,230	3,770
August	40.0	62.0	1,240	3,810
September	42.0	65.1	1,260	3,870
October	44.8	69.4	1,390	4,270
November	32.3	50.0	968	2,970
The period	26.4	40.9	8,810	27,000

NOTE.—The above summary has been compiled by the Geological Survey from records furnished by the Pioneer Mill Co. It represents the amount of underground water raised by eight pumps, seven steam and one electric, located in the vicinity of Lahaina, Maui. The measurements were obtained by means of pump displacement.

EAST MAUI.

THE DITCH COUNTRY.

The northeastern coast of East Maui is known locally as the "ditch country" on account of the large ditches which extend into this region from the west. These ditches have been built at different levels and at various times since 1879, all being extended eastward into the water-bearing regions. They form a regular system which takes water from all the streams west of Nahiku, the total number of streams intercepted being more than 40. West of Halehaku Stream there are six ditches, including the Kula pipe line which has recently been constructed at 4,000 feet elevation for domestic supply. West of Puohakamoa Stream there are four main ditches, one of which starts from the Makapipi Stream near Nahiku.

This region has been opened largely through the construction of these ditch systems. From Kailua near the center of the region to Nahiku at the east it is impossible to travel except on horseback or afoot, and then only along ditch trails for a greater part of the distance. The trip through this region is one of the most interesting in the group, with its numerous gulches and waterfalls and frequent glimpses of the blue sea a mile or two distant and from 1,000 to 1,500 feet below. The rainfall is exceedingly heavy in this region, ranging from 100 to 300 inches.

On account of the complicated system of diversions and impossibility of travel except along the ditches, all water-supply investigations in this region have been made along the ditch levels. It has also been necessary to depend on the ditch tenders for gage observers, and this limits the range that can be reached, as their other duties will not permit them to depart far from the ditch trail.

All the stations are considered in order along some one of the ditches from east to west.

Although the present system of ditches takes practically the entire water supply of this region at times when the streams are low, yet it is safe to say that but a fractional part of the total run-off is conserved and put to beneficial use owing to the lack of storage capacity. Streams which have a flow of but a few second-feet ordinarily may become raging torrents with a discharge of several thousand second-feet at times of heavy rainfall. The streams subside quickly when the rain ceases, but the periods of heavy rainfall are so frequent that a much greater supply of water than that now utilized might be had if sufficient storage capacity could be provided near the points of diversion.

KOOLAU DITCH REGION.

GENERAL FEATURES.

By the Koolau ditch region is meant that section of the northeast slope of East Maui from Keanae eastward to Nahiku.

Koolau ditch heads in Makapipi Stream above Nahiku and intercepts the water of all streams westward to Keanae inclusive. West of Keanae this ditch runs through an almost continuous tunnel and is not supposed to pick up any water east of Alo division weir. The principal streams contributing water to this ditch are Makapipi, Hanawi, Kahaula, Waiaaka, Paakea, Wiaohue, Kopiliula, East and West Wailuaiki, Wailuanui, and the various branches of Keanae Stream. All these streams rise in a region where the rainfall is from 200 to 300 inches. Water in excess of what the ditch can carry passes on down to the sea.

KOOLAU DITCH NEAR KEANAE, MAUI.

A staff gage was installed in Koolau ditch above Keanae shortly after its completion in 1904. Since that time readings have been made twice daily and the records kept in the office of the Maui Agricultural Co. The gage is graduated in inches and is placed on the left or mauka side of the ditch at an open section which appears to be permanent.

The Geological Survey has made a rating of the section by current meter measurements from which the daily discharge has been computed by means of the gage-height records furnished by the Maui Agricultural Co. The gage-height readings for this period were made under the immediate supervision of George Tripp. The discharge at this station shows the amount of water collected by the Koolau ditch from streams east of this point. This water is carried through tunnels to the Alo division weir several miles farther east without being augmented by inflow from other streams.

Discharge measurements of Koolau ditch near Keanae, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Inches.*	*Sec.-ft.*
Nov. 18	J. B. Stewart	10.1	44.3	51¾	155
Dec. 15	do	10.1	46.6	55¼	170

NOTE.—Additional measurements made in the early part of 1912 have been used in making a rating.

Daily discharge, in second-feet, of Koolau ditch near Keanae, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1.	76	178	50	195	85	189	70	56	58	132	30	195
2.	62	192	55	188	195	195	68	54	52	192	29	195
3.	56	179	130	192	171	170	78	190	60	195	27	195
4.	62	171	195	186	195	160	194	188	50	132	56	190
5.	192	161	165	151	169	171	162	164	48	77	29	195
6.	172	148	122	116	162	155	145	162	44	98	26	195
7.	132	132	158	170	195	192	158	140	39	121	28	148
8.	26	114	102	195	160	180	112	136	36	90	25	158
9.	13	106	82	180	182	190	92	132	33	158	24	140
10.	18	98	67	158	145	182	78	116	31	190	26	122
11.	76	100	60	149	160	178	88	88	30	109	25	106
12.	182	139	54	132	125	179	88	114	30	86	23	92
13.	182	166	49	119	129	195	66	182	30	70	22	84
14.	180	121	47	106	110	168	90	182	30	56	21	76
15.	168	99	44	104	110	195	195	142	29	51	20	68
16.	180	89	37	92	182	182	195	108	30	46	21	62
17.	185	74	36	150	135	165	188	92	29	42	60	61
18.	195	74	36	188	145	195	160	84	29	39	106	58
19.	188	73	63	145	188	158	134	76	28	36	132	56
20.	171	55	158	126	168	172	110	172	25	47	48	50
21.	190	100	180	106	138	158	89	190	25	55	40	50
22.	84	195	175	92	116	115	79	174	25	100	33	52
23.	30	105	185	96	112	140	76	169	23	126	54	55
24.	156	72	185	155	116	113	68	159	26	44	164	195
25.	152	76	185	162	109	105	97	178	22	44	54	195
26.	161	50	185	195	92	93	75	119	22	38	42	195
27.	192	54	176	132	81	84	66	114	20	34	36	182
28.	174	44	146	116	68	76	60	168	23	38	78	119
29.	168	.....	113	97	61	77	53	100	39	43	195	90
30.	175	.....	99	68	60	75	54	72	195	35	195	74
31.	192	.....	182	.....	195	.....	62	64	.....	32	.....	86
1911.												
1.	92	170	145	52	116	68	182	37	99	171	34	98
2.	106	195	102	44	164	98	128	55	119	160	36	86
3.	77	188	84	55	107	128	113	50	109	161	36	75
4.	195	190	70	46	83	148	156	39	87	168	34	69
5.	162	179	64	35	86	168	139	33	69	169	34	66
6.	13	180	60	31	114	159	140	31	59	165	44	121
7.	12	191	55	30	113	168	148	30	121	168	49	97
8.	68	195	50	29	100	168	136	29	160	168	96	168
9.	64	180	46	27	168	172	109	29	148	164	55	112
10.	185	165	48	26	172	171	125	26	98	142	44	96
11.	170	178	40	24	168	162	145	27	166	132	45	86
12.	180	171	37	24	150	155	156	28	160	119	36	82
13.	184	159	35	22	135	158	126	44	116	100	82	104
14.	131	130	36	22	169	162	105	29	100	94	131	175
15.	96	110	36	21	168	138	125	28	136	92	142	169
16.	88	.0	34	20	170	136	142	109	107	85	86	172
17.	77	.0	32	64	170	118	98	114	122	105	166	174
18.	72	.0	31	64	166	122	80	72	159	74	154	174
19.	63	.0	44	61	148	140	66	164	128	63	160	174
20.	59	.0	61	61	148	128	94	122	168	59	159	168
21.	56	5.1	42	64	170	156	62	70	155	57	170	158
22.	69	57	45	14	161	130	68	58	169	54	171	135
23.	56	52	32	3.0	155	106	92	52	171	51	166	112
24.	145	83	33	7.7	125	99	61	120	171	46	164	104
25.	158	72	32	12	109	106	54	156	170	51	132	93
26.	98	60	30	12	129	125	47	134	172	54	104	83
27.	122	119	28	12	121	132	44	92	170	43	91	80
28.	185	158	27	156	101	132	42	76	172	40	174	80
29.	144	.....	26	116	85	99	41	118	170	38	162	96
30.	101	.....	29	101	81	93	38	170	178	37	117	83
31.	160	.....	53	.....	77	.....	36	189	.....	36	.....	86

NOTE.—Daily discharge computed from a rating curve that is fairly well defined.

Monthly discharge of Koolau ditch near Keanae, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	195	13	135	8,300
February	195	44	113	6,280
March	195	36	114	7,010
April	195	58	142	8,450
May	195	60	137	8,420
June	195	75	154	9,160
July	195	53	105	6,460
August	190	54	132	8,120
September	195	20	38.7	2,300
October	195	32	82.5	5,070
November	195	20	55.6	3,310
December	195	50	121	7,440
The year	195	13	111	80,300
1911.				
January	195	12	109	6,700
February	195	5.1	114	6,330
March	145	26	48.0	2,950
April	156	3.0	41.9	2,490
May	172	77	133	8,180
June	172	68	135	8,030
July	182	36	99.9	6,140
August	189	26	75.2	4,620
September	178	59	138	8,210
October	171	36	98.9	6,080
November	174	34	102	6,070
December	175	75	115	7,070
The year	195	3.0	101	72,900

KOOLAU DITCH AT ALO DIVISION WEIR, NEAR HUELO, MAUI.

The Alo division weir is at the west end of Koolau ditch just east of Waikamoi Gulch. This weir consists of nine panels, each 29 inches long. It is designed as a division weir, two-thirds of the water going to the Maui Agricultural Co. through New Hamakua ditch and the other third going to the Hawaiian Commercial & Sugar Co. through the old Spreckels ditch, which passes under the weir at that point.

The head on the weir is recorded by clock register. The records of head for the past four years have been furnished to the Geological Survey by the Maui Agricultural Co. and the Hawaiian Commercial & Sugar Co. During 1911 a series of careful meter measurements was made in the flume just above the weir basin. These measurements give a well-defined curve which shows a much larger quantity of water at all gage heights than the weir formula for sharp-crested weir. (See fig. 1, p. 18.)

Discharge measurements of Koolau ditch at Alo division weir, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 4	C. H. Pierce	7.9	29.2	0.84	61
Nov. 10	J. B. Stewart	8.0	27.2	.67	43.8
10	do	8.0	27.2	.67	42.8
14	do	8.0	33.6	1.46	138
23	do	8.0	26.0	.54	30.0
23	do	8.0	25.3	.45	23.6
23	do	8.0	27.3	.68	43.4
23	do	8.0	29.3	.94	70
23	do	8.0	29.6	.97	75
23	do	8.0	33.7	1.47	143
Dec. 5	do	8.0	29.1	.93	69
13	do	8.0	31.5	1.22	103

NOTE.—Measurements made in flume above division weir. Gage height obtained by measuring the head on the weir.

Daily gage height, in feet, of Koolau ditch at Alo division weir, near Huelo, Maui, for 1908–1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	1.55	1.55	0.70	0.50	1.0	0.70	0.75	1.4	1.55	0.9	0.60	1.55
2	1.45	1.5	.70	.65	.9	.7	1.05	1.55	1.55	.85	.55	1.5
3	1.25	1.35	.65	1.20	.95	.7	1.3	1.55	1.55	.85	.55	1.35
4	1.05	1.55	.60	1.00	1.15	.65	1.5	1.3	1.45	.85	.80	1.35
5	.9	1.55	1.15	1.15	1.05	.7	1.25	1.3	1.4	.8	1.45	1.15
6	.8	1.6	.85	1.15	1.4	.75	1.0	1.4	1.4	.8	.95	1.3
7	.75	1.6	.70	.90	1.1	.7	.9	1.5	1.25	.8	1.0	1.55
8	.7	1.6	.65	1.45	1.2	.65	.85	1.5	1.10	1.2	.9	1.55
9	.7	1.55	.60	1.55	1.15	.65	.8	1.5	1.05	.9	.75	1.55
10	.65	1.55	.60	1.5	1.05	.6	.8	1.35	1.05	.8	.7	1.55
11	.6	1.55	.60	1.55	1.15	.65	.75	1.2	1.4	.75	.7	1.5
12	.6	1.5	.55	1.55	1.05	.65	.85	1.4	1.55	.7	.65	1.35
13	.6	1.45	.55	1.55	.9	.6	.8	1.5	1.45	.7	.6	1.25
14	.55	1.3	.55	1.50	.85	.65	.85	1.5	1.45	.85	.6	1.15
15	1.55	1.25	.55	1.60	.95	1.05	.85	1.4	1.4	1.2	.6	1.05
16	1.25	1.25	.50	1.50	.8	.9	.75	1.35	1.45	.8	.55	1.0
17	1.35	1.1	.65	1.40	.85	.75	.7	1.2	1.25	.75	.8	1.1
18	.95	1.05	.80	1.4	.75	1.0	.7	1.05	1.55	.95	.65	1.5
19	.85	1.05	1.20	1.3	.8	.95	.7	1.0	1.55	.85	.65	1.55
20	.9	1.05	.75	1.45	.7	.85	.85	.9	1.55	1.15	.60	1.55
21	.8	1.00	.65	1.5	.8	1.15	1.25	.85	1.55	1.35	.55	1.55
22	.7	.95	.60	1.45	.95	1.45	1.15	.85	1.5	1.05	.50	1.55
23	.65	.90	.55	1.25	1.5	1.55	.85	1.0	1.35	1.05	.50	1.5
24	.6	.90	.55	1.15	1.1	1.55	.75	1.6	1.25	1.15	1.0	1.5
25	.6	.85	.55	1.05	.9	1.4	1.2	1.55	1.15	.95	1.5	1.55
26	.6	.80	.50	1.0	.85	1.2	1.35	1.55	1.05	.85	1.55	1.55
27	.6	.75	.50	.95	.8	1.05	1.2	1.55	1.0	.75	1.55	1.55
28	.6	.75	.50	1.15	.9	.95	1.35	1.45	1.0	.75	1.65	1.55
29	.6	.70	.45	1.05	.85	.85	1.05	1.25	.95	.70	1.5	1.55
30	.7	.....	.45	1.10	.8	.8	1.45	1.3	.95	.7	1.5	1.55
31	1.25	.....	.45	.....	.75	.....	1.5	1.55	.....	.65	.....	1.5
1909.												
1	1.45	1.55	1.55	1.5	.65	1.25	1.55	1.4	.9	1.2	1.0	.45
2	1.5	1.45	1.55	1.25	.8	1.05	1.5	1.4	.85	1.4	.9	.45
3	1.45	1.25	1.55	1.0	1.45	.95	1.45	1.3	.8	1.4	1.15	.85
4	1.35	1.10	1.55	1.05	1.55	.9	1.3	1.25	.8	1.25	1.2	.50
5	1.25	1.05	1.55	1.0	1.55	.85	1.15	1.15	.75	1.3	.9	.45
6	1.2	1.25	1.55	.95	1.45	.85	1.3	1.1	.7	1.25	.75	.45
7	1.25	1.5	1.55	1.2	1.4	.8	1.55	1.1	.7	1.1	.95	.4
8	1.1	1.3	1.55	1.0	1.35	.8	1.55	1.1	.9	1.0	1.05	.4
9	1.0	1.1	1.5	1.15	1.25	.75	1.5	1.05	.75	.95	.85	.4
10	.95	1.0	1.55	.85	1.5	.7	1.5	1.15	.7	.9	.95	.4

Daily gage height, in feet, of Koolau ditch at Alo division weir, near Huelo, Maui, for 1908–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
11	0.95	0.95	1.4	0.5	1.35	0.7	1.5	1.05	0.75	0.9	0.85	0.35
12	.9	1.1	.9	.4	1.45	.85	1.55	1.0	.85	1.05	.8	.35
13	.85	1.15	.7	.75	1.5	.8	1.55	1.0	.85	.85	1.25	.35
14	.8	.95	.75	.75	1.5	1.1	1.55	.95	1.05	.8	1.15	.35
15	.75	.85	.75	.7	1.4	1.55	1.55	.8	.85	1.2	.95	.35
16	.75	.8	.65	1.05	1.3	1.35	1.55	.85	.95	1.2	.85	.4
17	.7	1.4	.1	1.0	1.2	1.2	1.55	.9	.95	.95	.75	1.4
18	.65	1.55	.0	.95	1.2	1.1	1.55	.85	.9	.85	.7	1.45
19	.65	1.45	.0	.95	1.2	1.2	1.55	1.0	1.3	.8	.7	1.55
20	.65	1.35	.0	.9	1.1	1.55	1.55	1.05	1.15	.8	.65	1.5
21	.6	1.2	.0	.85	1.0	1.3	1.55	1.1	.95	1.05	.6	1.45
22	.6	1.1	.0	.8	1.0	1.2	1.5	1.25	1.0	.85	.6	1.45
23	.75	1.45	.0	.8	.95	1.05	1.45	1.5	1.5	1.45	.55	1.55
24	.9	1.55	.1	.75	.9	1.35	1.45	1.45	1.55	1.05	.55	1.5
25	.85	1.55	.1	.7	.85	1.5	1.5	1.2	1.35	.9	.55	1.4
26	1.3	1.55	.6	.7	1.2	1.3	1.5	1.1	1.25	.8	.5	1.55
27	1.5	1.15	1.3	.65	1.45	1.2	1.55	1.0	1.5	.8	.5	1.5
28	1.3	1.55	1.2	.65	1.1	1.35	1.55	.95	1.5	.75	.45	1.25
29	1.4	.....	1.2	.65	1.1	1.2	1.55	.95	1.45	.7	.45	1.2
30	1.5	.....	1.45	.6	1.0	1.55	1.55	.9	1.35	.9	.45	1.45
31	1.55	.....	1.45	.....	1.0	.....	1.5	.95	.....	1.2	.....	1.2
1910.												
1	1.05	1.55	0.85	1.55	1.25	1.55	0.95	0.85	0.9	1.25	0.5	1.55
2	.95	1.55	.9	1.55	1.55	1.55	1.0	.95	.85	1.55	.5	1.55
3	.9	1.55	1.55	1.55	1.5	1.55	1.25	1.55	.9	1.55	.55	1.5
4	1.2	1.5	1.60	1.55	1.55	1.5	1.55	1.55	.85	1.25	.6	1.55
5	1.55	1.55	1.5	1.5	1.5	1.5	1.45	1.5	.8	1.05	.5	1.55
6	1.45	1.5	1.4	1.5	1.5	1.5	1.45	1.5	.75	1.15	.5	1.55
7	1.3	1.4	1.45	1.5	1.55	1.55	1.4	1.4	.7	1.3	.45	1.45
8	.95	1.35	1.2	1.55	1.55	1.5	1.25	1.4	.65	1.3	.45	1.45
9	.65	1.25	1.1	1.5	1.55	1.55	1.15	1.4	.6	1.5	.45	1.4
10	.15	1.2	1.0	1.5	1.5	1.55	1.10	1.25	.6	1.5	.45	1.35
11	.95	1.25	.95	1.45	1.5	1.55	1.2	1.15	.55	1.2	.4	1.2
12	1.55	1.35	.85	1.4	1.4	1.55	1.1	1.4	.55	1.05	.4	1.15
13	1.55	1.5	.85	1.35	1.4	1.55	.95	1.55	.55	.9	.4	1.1
14	1.55	1.35	.8	1.25	1.25	1.5	1.25	1.5	.5	.8	.35	1.05
15	1.55	1.2	.75	1.25	1.4	1.55	1.55	1.4	.5	.75	.35	.95
16	1.55	1.15	.7	1.15	1.55	1.5	1.55	1.25	.55	.7	.45	.9
17	1.55	1.05	.7	1.5	1.4	1.5	1.55	1.25	.55	.65	1.0	.85
18	1.55	1.1	.7	1.55	1.5	1.5	1.5	1.1	.5	.65	1.15	.8
19	1.55	.95	1.2	1.45	1.55	1.5	1.35	1.1	.45	.6	1.15	.8
20	1.55	.8	1.45	1.35	1.5	1.5	1.25	1.55	.45	.9	.7	.75
21	1.55	1.25	1.55	1.3	1.4	1.5	1.15	1.55	.45	.75	.65	.75
22	.7	1.55	1.55	1.2	1.35	1.45	1.1	1.5	.4	1.25	.55	.75
23	.95	1.25	1.55	1.3	1.35	1.4	1.05	1.5	.4	1.1	1.05	1.1
24	1.5	1.05	1.55	1.5	1.35	1.35	1.0	1.5	.45	.75	1.2	1.55
25	1.5	.95	1.5	1.55	1.25	1.25	1.2	1.5	.4	.7	.7	1.55
26	1.5	.85	1.55	1.55	1.15	1.2	1.05	1.35	.4	.6	.6	1.6
27	1.55	.85	1.5	1.4	1.1	1.1	.95	1.4	.35	.6	.6	1.5
28	1.55	.8	1.45	1.3	1.0	1.05	.9	1.45	.4	.7	1.2	1.25
29	1.55	.....	1.3	1.15	.95	1.05	.85	1.2	1.0	.65	1.6	1.05
30	1.55	.....	1.3	1.15	1.05	1.05	.85	1.05	1.55	.55	1.55	.95
31	1.55	.....	1.5	.....	1.55	.....	.85	.95	.....	.55	.....	1.2
1911.												
1	1.3	1.5	1.45	0.9	1.3	1.05	1.5	0.7	1.15	1.55	0.6	1.2
2	1.15	1.5	1.2	1.0	1.45	1.2	1.35	.8	1.3	1.5	.6	1.05
3	1.15	1.5	1.15	1.0	1.25	1.5	1.3	.85	1.15	1.55	.6	1.0
4	1.55	1.5	1.05	.8	1.1	1.5	1.45	.7	1.1	1.55	.55	1.0
5	.95	1.5	1.0	.7	1.2	1.55	1.45	.65	.95	1.55	.65	1.0
6	.20	1.5	.95	.7	1.35	1.5	1.45	.6	.95	1.5	.65	1.2
7	.65	1.5	.9	.65	1.3	1.55	1.45	.55	1.4	1.55	.75	1.25
8	1.05	1.55	.85	.6	1.35	1.55	1.4	.55	1.5	1.5	1.1	1.45
9	1.05	1.5	.8	.6	1.55	1.55	1.4	.55	1.4	1.5	.75	1.2
10	1.5	1.5	.8	.55	1.55	1.55	1.4	.5	1.3	1.45	.65	1.15
11	1.5	1.55	.75	.5	1.5	1.5	1.45	.5	1.55	1.45	.65	1.1
12	1.55	1.55	.7	.55	1.45	1.5	1.5	.6	1.5	1.35	.6	1.15
13	1.5	1.5	.7	.5	1.4	1.5	1.3	.65	1.3	1.25	1.15	1.2
14	1.35	1.4	.7	.5	1.5	1.5	1.3	.55	1.25	1.2	1.45	1.5
15	1.15	1.2	.7	.5	1.5	1.4	1.4	.75	1.35	1.2	1.3	1.55

Daily gage height, in feet, of Koolau ditch, at Alo division weir, near Huelo, Maui, for 1908–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
16	1.10	0.1	0.65	0.55	1.5	1.4	1.4	1.35	1.25	1.2	1.1	1.55
17	1.05	.0	.65	.95	1.5	1.3	1.2	1.15	1.4	1.15	1.45	1.55
18	.95	.0	.6	1.05	1.5	1.4	1.05	1.15	1.5	1.05	1.4	1.55
19	.9	.0	1.05	1.0	1.45	1.4	1.05	1.55	1.4	.95	1.45	1.55
20	.85	.0	.95	1.05	1.5	1.4	1.05	1.25	1.55	.95	1.45	1.55
21	.8	.6	.85	1.05	1.55	1.45	.95	1.0	1.5	.9	1.5	1.5
22	.95	.9	.8	.05	1.55	1.4	1.0	.9	1.55	.9	1.5	1.4
23	.95	.85	.7	.0	1.5	1.25	1.05	.9	1.55	.8	1.25	1.3
24	1.4	1.25	.7	.0	1.4	1.25	.95	1.4	1.55	.9	1.55	1.25
25	1.35	1.05	.65	.0	1.3	1.3	.85	1.5	1.55	.9	1.35	1.15
26	1.1	1.05	.65	.45	1.4	1.4	.8	1.35	1.55	.85	1.2	1.1
27	1.45	1.35	.6	.75	1.35	1.4	.75	1.15	1.55	.75	1.2	1.05
28	1.5	1.5	.6	1.4	1.2	1.35	.7	1.0	1.55	.7	1.55	1.2
29	1.35	.....	.55	1.3	1.15	1.2	.7	1.5	1.55	.7	1.5	1.15
30	1.25	.....	.6	1.35	1.1	1.2	.65	1.55	1.55	.65	1.3	1.15
31	1.5	.....	1.0	.....	1.05	.....	.65	1.4	.....	.65	.....	1.1

NOTE.—Gage height taken from clock record sheet and is depth of water on crest of 9-panel weir. Length of each panel is 29 inches.

Daily discharge, in second-feet, of Koolau ditch, at Alo division weir, near Huelo, Maui, for 1908–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	151	151	46	28	77	46	51	128	151	66	37	151
2	136	143	46	42	66	46	83	151	151	61	32	143
3	108	121	42	101	72	46	114	151	151	61	32	121
4	83	151	37	77	95	42	143	114	136	61	56	121
5	66	151	95	95	83	46	108	114	128	56	136	95
6	56	159	61	95	128	51	77	128	128	56	72	114
7	51	159	46	66	88	46	66	143	108	56	77	151
8	46	159	42	136	101	42	61	143	88	101	66	151
9	46	151	37	151	95	42	56	143	83	66	51	151
10	42	151	37	143	83	37	56	121	83	56	46	151
11	37	151	37	151	95	42	51	101	128	51	46	143
12	37	143	32	151	83	42	61	128	151	46	42	121
13	37	136	32	151	66	37	56	143	136	46	37	108
14	32	114	32	143	61	42	61	143	136	61	37	95
15	151	108	32	159	72	83	61	128	128	101	37	83
16	108	108	28	143	56	66	51	121	136	56	32	77
17	121	88	42	128	61	51	46	101	108	51	56	88
18	72	83	56	128	51	77	46	83	151	72	42	143
19	61	83	101	114	56	72	46	77	151	61	42	151
20	66	83	51	136	46	61	61	66	151	95	37	151
21	56	77	42	143	56	95	108	61	151	121	32	151
22	46	72	37	136	72	136	95	61	143	83	28	151
23	42	66	32	108	143	151	61	77	121	83	28	143
24	37	66	32	95	88	151	51	159	108	95	77	143
25	37	61	32	83	66	128	101	151	95	72	143	151
26	37	56	28	77	61	101	121	151	83	61	151	151
27	37	51	28	72	56	83	101	151	77	51	151	151
28	37	51	28	95	66	72	121	136	77	51	168	151
29	37	46	24	83	61	61	83	108	72	46	143	151
30	46	.....	24	88	56	56	136	114	72	46	143	151
31	108	.....	24	.....	51	.....	143	151	.....	42	.....	143
1909.												
1	136	151	151	143	42	108	151	128	66	101	77	24
2	143	136	151	108	56	83	143	128	61	128	66	24
3	136	108	151	77	136	72	136	114	56	128	95	61
4	121	88	151	83	151	66	114	108	56	108	101	28
5	108	83	151	77	151	61	95	95	51	114	66	24
6	101	108	151	72	136	61	114	88	46	108	51	24
7	108	143	151	101	128	56	151	88	46	88	72	20
8	88	114	151	77	121	56	151	88	66	77	83	20
9	77	88	143	95	108	51	143	83	51	72	61	20
10	72	77	151	61	143	46	143	95	46	66	72	20

Daily discharge, in second-feet, of Koolau ditch, at Alo division weir, near Huelo, Maui, for 1908–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
11	72	72	128	28	121	46	143	83	51	66	61	16
12	66	88	66	20	136	61	151	77	61	83	56	16
13	61	95	46	51	143	56	151	77	61	61	108	16
14	56	72	51	51	143	88	151	72	83	56	95	16
15	51	61	51	46	128	151	151	66	61	101	72	16
16	51	56	42	83	114	121	151	61	72	101	61	20
17	46	128	2.8	77	101	101	151	66	72	72	51	128
18	42	151	0.0	72	101	88	151	61	66	61	46	136
19	42	136	0.0	72	101	101	151	77	114	56	46	151
20	42	121	0.0	66	88	151	151	83	95	56	42	143
21	37	101	0.0	61	77	114	151	88	72	83	37	136
22	37	88	0.0	56	77	101	143	108	77	61	37	136
23	51	136	0.0	56	72	83	136	143	143	136	32	151
24	66	151	2.8	51	66	121	136	136	151	83	32	143
25	61	151	2.8	46	61	143	143	101	121	66	32	128
26	114	151	37	46	101	114	143	88	108	56	28	151
27	143	95	114	42	136	101	151	77	143	56	28	143
28	114	151	101	42	88	121	151	72	143	51	24	108
29	128	.....	101	42	88	101	151	72	136	46	24	101
30	143	.....	136	37	77	151	151	66	121	66	24	136
31	151	.....	136	.....	77	.....	143	72	.....	101	.....	101
1910.												
1	83	151	61	151	108	151	72	61	66	108	28	151
2	72	151	66	151	151	151	77	72	61	151	28	151
3	66	151	151	151	143	151	108	151	66	151	32	143
4	101	143	159	151	151	143	151	151	61	108	37	151
5	151	151	143	143	143	143	136	143	56	83	28	151
6	136	143	128	143	143	143	136	143	51	95	28	151
7	114	128	136	143	151	151	128	128	46	114	24	136
8	72	121	101	151	151	143	108	128	42	114	24	136
9	42	108	88	143	151	151	95	128	37	143	24	128
10	5	101	77	143	143	151	88	108	37	143	24	121
11	72	108	72	136	143	151	101	95	32	101	20	101
12	151	121	61	128	128	151	88	128	32	83	20	95
13	151	143	61	121	128	151	72	151	32	66	20	88
14	151	121	56	108	108	143	108	143	28	56	16	83
15	151	101	51	108	128	151	151	128	28	51	16	72
16	151	95	46	95	151	143	151	108	32	46	24	66
17	151	83	46	143	128	143	151	108	32	42	77	61
18	151	88	46	151	143	143	143	88	28	42	95	56
19	151	72	101	136	151	143	121	88	24	37	95	56
20	151	56	136	121	143	143	108	151	24	66	46	51
21	151	108	151	114	128	143	95	151	24	51	42	51
22	46	151	151	101	121	136	88	143	20	108	32	51
23	72	108	151	114	121	128	83	143	20	88	83	88
24	143	83	151	143	121	121	77	143	24	51	101	151
25	143	72	143	151	108	108	101	143	20	46	46	151
26	143	61	151	151	95	101	83	121	20	37	37	159
27	151	61	143	128	88	88	72	128	16	37	37	143
28	151	56	136	114	77	83	66	136	20	46	101	108
29	151	.....	114	95	72	83	61	101	77	42	159	83
30	151	.....	114	95	83	83	61	83	151	32	151	72
31	151	.....	143	.....	151	.....	61	72	.....	32	.....	101
1911.												
1	114	143	136	66	114	83	143	46	95	151	37	101
2	95	143	101	77	136	101	121	56	114	143	37	83
3	95	143	95	77	108	143	114	61	95	151	37	77
4	151	143	83	56	88	143	136	46	88	151	32	77
5	72	143	77	46	101	151	136	42	72	151	42	77
6	7.1	143	72	46	121	143	136	37	72	143	42	101
7	42	143	66	42	114	151	136	32	128	151	51	108
8	83	151	61	37	121	151	128	32	143	143	88	136
9	83	143	56	37	151	151	128	32	128	143	51	101
10	143	143	56	32	151	151	128	28	114	136	42	95
11	143	151	51	28	143	143	136	28	151	136	42	88
12	151	151	46	32	136	143	143	37	143	121	37	95
13	143	143	46	28	128	143	114	42	114	108	95	101
14	121	128	46	28	143	143	114	32	108	101	136	143
15	95	101	46	28	143	128	128	51	121	101	114	151

Daily discharge, in second-feet, of Koolau ditch, at Alo division weir, near Huelo, Maui, for 1908–1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
16	88	2.8	42	32	143	128	128	121	108	101	88	151
17	83	0.0	42	72	143	114	101	95	128	95	136	151
18	72	0.0	37	83	143	128	83	95	143	83	128	151
19	66	0.0	83	77	136	128	83	151	128	72	136	151
20	61	0.0	72	83	143	128	83	108	151	72	136	151
21	56	37	61	83	151	136	72	77	143	66	143	143
22	72	66	56	1.4	151	128	77	66	151	66	143	128
23	72	61	46	0	143	108	83	66	151	56	108	114
24	128	108	46	0	128	108	72	128	151	66	151	108
25	121	83	42	0	114	114	61	143	151	66	121	95
26	88	83	42	24	128	128	56	121	151	61	101	88
27	136	121	37	51	121	128	51	95	151	51	101	83
28	143	143	37	128	101	121	46	77	151	46	151	101
29	121	.....	32	114	95	101	46	143	151	46	143	95
30	108	.....	37	121	88	101	42	151	151	42	114	95
31	143	.....	77	.....	83	.....	42	128	.....	42	.....	88

NOTE.—Daily discharge computed from a current meter rating curve that is well defined

Monthly discharge of Koolau ditch at Alo division weir, near Huelo, Maui, for 1908–1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1908.				
January	151	32	65.4	4,020
February	159	46	108	6,210
March	101	24	40.7	2,500
April	159	28	111	6,600
May	143	46	74.5	4,580
June	151	37	68.4	4,070
July	143	46	79.9	4,910
August	159	61	121	7,440
September	151	72	119	7,080
October	121	42	65.5	4,030
November	168	28	68.6	4,080
December	151	77	134	8,240
The year	168	24	87.8	63,800
1909.				
January	151	37	85.9	5,280
February	151	56	111	6,160
March	151	0.0	81.3	5,000
April	143	20	64.6	3,840
May	151	42	105	6,460
June	151	46	92.5	5,500
July	151	95	143	8,790
August	143	61	89.1	5,480
September	151	46	83.2	4,950
October	136	46	80.9	4,970
November	108	24	56.0	3,330
December	151	16	76.0	4,670
The year	151	0.0	89.1	64,400
1910.				
January	151	5.0	120	7,380
February	151	56	108	6,000
March	159	46	108	6,640
April	151	95	131	7,800
May	151	72	127	7,810
June	151	83	134	7,970
July	151	61	101	6,210
August	151	61	121	7,440
September	151	16	40.2	2,390
October	151	32	76.5	4,700
November	159	16	49.8	2,960
December	159	51	107	6,580
The year	159	5.0	102	73,900

Monthly discharge of Koolau ditch at Alo division weir, near Huelo, Maui, for 1908–1911—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1911.				
January	151	7.1	99.9	6,140
February	151	0.0	101	5,610
March	136	32	58.9	3,620
April	128	0.0	51.0	3,030
May	151	83	126	7,750
June	151	83	129	7,680
July	143	42	98.9	6,080
August	151	28	76.4	4,700
September	151	72	128	7,620
October	151	42	98.7	6,070
November	151	32	92.8	5,520
December	151	77	111	6,820
The year	151	0.0	97.5	70,600

SPRECKELS DITCH REGION.

GENERAL FEATURES.

The Spreckels ditch region embraces that section of the ditch country west of Keanae and east of Kailua. Spreckels ditch heads in Nuaailua Stream at an elevation somewhat less than 2,000 feet, and intercepts all streams westward to Nailiilihaele Stream. This ditch is one of the early ditches built in the islands and consists of a series of ditches which take out water from one stream, carry it across the ridge, and drop it into another stream, to be picked up in a similar manner lower down. This ditch is really an extension of the Haiku ditch. It intercepts water from the following streams: Nuaailua, Honomanu, Ulawina, Kolea Nos. 1, 2, and 3, Haipuaena, Puohakamoa, Alo, Waikamoi, Kolea, Punaluu, and Oopuola.

The largest streams contributing water to this ditch are Honomanu, Haipuaena, and Puohakamoa, which rise on the northern slope of Haleakala at a distance of 6 or 8 miles from the sea.

HAIPUAENA STREAM NEAR HUELO, MAUI.

Haipuaena is one of the large streams intercepted by the East Maui ditches. It is just east of Puahakamoa Stream and is west of Honomanu. It rises well up on the mountain side and its flow is fairly good at all times.

A gaging station was established on this stream about 100 feet above the trail crossing and ditch intake, December 18, 1910. This station is about 6½ miles by trail southeast of Kailua (Huelo post office).

A vertical staff gage, graduated to tenths of a foot, is fastened to the left bank and is used to obtain gage heights.

The discharge at this station includes the total flow of the stream itself and the flow of Spreckels ditch as measured at station No. 3. Spreckels ditch is turned into Haipuaena Stream several hundred feet above the station on the stream and takes out again about 100 feet

below this station. To obtain discharge of Haipuaena Stream alone, subtract discharge of Spreckels ditch at station No. 3.

Discharge measurements of Haipuaena Stream near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 21	C. H. Pierce	14.8	20.5	0.80	15.3
Apr. 3	.....do	14.2	21.0	1.00	30.3
Nov. 15	J. B. Stewart	.....	.....	1.35	[a]49.2

[a] Discharge was obtained by adding the flow of Spreckels ditch to that of the stream below ditch intake.

NOTE.—Measurements made at various sections.

Daily gage height, in feet, of Haipuaena Stream near Huelo, Maui, for 1910–11.

[Tom Pahukoa and Kumagai, observers.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	.....	11	.....	21	0.80
2	.....	12	.....	22	.90
3	.....	13	.....	23	.90
4	.....	14	.....	24	1.60
5	.....	15	.....	25	.....
6	.....	16	.....	26	2.80
7	.....	17	.....	27	2.60
8	.....	18	0.70	28	1.20
9	.....	19	.80	29	1.10
10	.....	20	.70	30	1.03
				31	.....

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.6	1.97	1.27	0.97	1.23	0.95	1.5	0.8	1.15	1.48	0.5	1.0
2	1.32	2.00	.91	1.74	1.67	1.3	1.3	1.03	1.48	1.35	.5	.9
3	1.2	1.84	.85	1.01	1.10	1.65	1.2	1.15	1.73	1.4	.5	.83
4	1.85	2.05	.75	.87	1.09	1.75	1.45	.75	1.2	1.4	.45	.83
5	1.64	1.70	.71	.81	1.32	1.75	1.3	.78	1.0	1.45	.48	.83
6	1.42	2.90	.68	.74	1.65	1.6	1.4	.7	1.0	1.35	.68	1.15
7	1.24	1.62	.67	.81	1.69	2.8	1.4	.65	1.65	1.55	.75	1.1
8	1.12	2.80	.65	.65	1.72	1.7	1.35	.6	1.75	1.45	1.18	1.45
9	1.03	2.85	.60	.6	2.4	1.65	1.3	.6	1.20	1.3	.73	1.08
10	2.62	4.20	.67	.6	1.72	1.75	1.4	.58	1.15	1.2	.63	.98
11	2.72	1.50	.6	.58	1.62	1.40	1.5	.63	1.80	1.1	.58	.88
12	1.61	1.20	.53	.55	1.64	1.35	1.45	.7	1.4	1.0	.50	.85
13	1.71	1.1	.5	.54	1.44	1.45	1.3	1.0	1.25	.98	1.35	1.13
14	1.34	1.12	.67	.53	1.78	1.35	1.3	.7	1.18	.88	1.53	2.2
15	1.18	1.07	.69	.53	1.78	1.3	1.55	.68	1.4	.88	1.3	2.7
16	1.32	.97	.65	.49	1.62	1.5	1.35	1.4	1.18	.88	.95	1.75
17	1.12	.89	.62	1.44	1.61	1.3	1.2	1.3	1.35	1.0	1.75	1.48
18	1.0	.84	.57	1.41	1.45	1.32	1.1	1.28	1.43	.8	1.33	1.78
19	.9	.8	1.2	2.65	1.28	1.35	1.0	1.75	1.3	.73	1.55	1.68
20	.75	.9	.81	1.42	1.75	1.3	1.1	1.2	1.6	.7	1.7	1.45
21	.8	.75	.89	1.65	1.60	1.35	1.0	1.0	1.4	.73	1.7	1.3
22	.85	.7	.67	1.44	1.94	1.3	1.1	.73	1.65	.7	2.4	1.2
23	.74	.68	.62	3.9	1.7	1.2	1.15	.9	1.78	.68	1.45	1.05
24	1.65	1.64	.6	1.47	1.32	1.3	.95	1.5	1.8	.63	1.4	1.03
25	1.32	.87	.73	2.47	1.09	1.33	.85	1.45	1.4	.73	1.4	.95
26	1.24	.81	.95	2.00	1.34	1.5	.83	1.33	2.0	.7	1.18	.85
27	2.1	1.97	.65	1.8	1.25	1.35	.85	1.23	1.75	.63	1.0	.8
28	1.34	1.74	.61	1.46	1.2	1.3	.75	1.05	1.63	.6	1.55	.78
29	1.28	.....	.6	1.42	1.8	1.23	.7	2.7	1.48	.58	1.33	1.03
30	1.18	.....	.81	1.25	1.2	1.3	.75	1.55	2.7	.63	1.15	1.03
31	1.84	.....	1.45	.....	1.19	.....	.68	1.3	.....	.55	.....	.98

NOTE.—Gage was read but once a day, the reading being taken in the afternoon.

Daily discharge, in second-feet, of Haipuaena Stream near Huelo, Maui, for 1910–11.

[Tom Pahukoa and Kumaga, observers.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	20
2		12		22	24
3		13		23	24
4		14		24	62
5		15		25	[a] 103
6		16		26	144
7		17		27	130
8		18	16	28	38
9		19	20	29	33
10		20	16	30	29
				31	[a] 46

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	62	87	41	27	39	26	56	20	35	54	8.5	28
2	45	88	24	71	65	44	44	29	54	46	8.5	24
3	38	76	22	28	33	64	38	35	70	50	8.5	21
4	78	92	18	22	32	71	52	18	38	50	7.2	21
5	65	68	16	20	45	71	44	19	28	52	8.1	21
6	51	151	15	18	65	62	50	16	28	46	15	35
7	40	63	15	20	68	144	50	14	64	58	18	33
8	34	144	14	14	69	68	46	12	71	52	37	52
9	30	148	12	12	116	64	44	12	38	44	17	32
10	131	250	15	12	69	71	50	11	35	38	13	27
11	138	56	12	11	63	50	56	13	74	33	11	23
12	62	38	94	10	64	46	52	16	50	28	8.5	21
13	68	33	8.5	9.7	52	52	44	28	40	27	46	34
14	46	34	15	9.4	73	46	44	16	37	15	57	102
15	37	31	16	9.4	73	44	58	15	50	15	44	137
16	45	27	14	8.5	63	56	46	50	37	15	26	71
17	34	24	13	52	62	44	38	44	46	28	71	54
18	28	21	11	50	52	45	33	42	51	20	45	73
19	24	20	38	134	42	46	28	71	44	17	58	66
20	18	24	20	51	71	44	33	38	62	16	68	52
21	20	18	24	65	62	46	28	28	50	17	68	44
22	22	16	15	52	84	44	33	17	64	16	116	38
23	18	15	13	221	68	38	35	24	73	15	52	30
24	65	64	12	53	45	44	26	56	74	13	50	29
25	45	22	17	121	32	45	21	52	50	17	50	26
26	40	20	26	88	46	56	21	45	88	16	37	21
27	95	87	14	74	40	46	21	39	71	13	28	20
28	46	71	12	53	38	44	18	30	63	12	58	19
29	43	.....	12	51	74	39	16	137	54	11	45	29
30	37	.....	20	41	38	44	18	58	137	13	35	29
31	76	.....	53	.....	37	.....	15	44	.....	10	.....	27

[a] Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve fairly well defined between 20 and 50 second-feet.

Monthly discharge of Haipuaena Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	144	16	50.4	1,400	D.
1911.					
January	138	18	51	3,140	C.
February	250	15	63.9	3,550	D.
March	94	8.5	21	1,290	C.
April	221	8.5	46.9	2,790	D.
May	116	32	57.4	3,530	C.
June	144	26	53.5	3,180	C.
July	58	15	37.4	2,300	C.
August	137	11	33.8	2,080	C.
September	137	28	55.9	3,330	C.
October	58	10	27.6	1,700	C.
November	116	7.2	37.1	2,210	D.
December	137	19	40.0	2,460	C.
The year	250	7.2	43.6	31,600	

NOTE.—These estimates include the flow of Spreckels ditch. To get flow of Haipuaena Stream alone, subtract flow of Spreckels ditch at station No. 3.

PUOHAKAMOA STREAM NEAR HUELO, MAUI.

Puohakamoa Stream is one of the largest streams intercepted by the East Maui ditches. It is east of Waikamoi and west of Haipuaena streams and reaches high up on the slope of Haleakala.

A gaging station was established on this stream at the bridge on the trail crossing, about 6 miles by trail southeast of Kailua (Huelo post office), December 18, 1910.

The gage is fastened to stones and to the bridge pier only a few feet below the inflow from Spreckels ditch. It is graduated into tenths of feet and consists of two sections.

The discharge at this station includes the flow of Spreckels ditch at station No. 4 as well as the total flow of the stream. The water is again diverted through Spreckels ditch a few hundred feet below the station and excess water may be picked up by the Center ditch at a lower elevation. To obtain the discharge of Puohakamoa Stream alone, subtract discharge of Spreckels ditch at station No. 4.

Discharge measurements of Puohakamoa Stream near Huelo, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 17	C. H. Pierce	19.0	32.7	0.86	26.2
1911.					
Jan. 21	do	20.5	32.2	0.90	28.0
Apr. 4[a]	do	7.3	8.2	1.03	41.1

[a] Measurement made in ditch near diversion dam. Total flow of stream was being diverted.

NOTE.—Measurements made by wading just above bridge, except as noted.

Daily gage height, in feet, of Puohakamoa Stream near Huelo, Maui, for 1910–11.

[Tokunaga, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	0.88
2		12		22	.90
3		13		23	.92
4		14		24	3.32
5		15		25	
6		16		26	4.67
7		17		27	1.60
8		18	0 82	28	1.28
9		19	.80	29	1.14
10		20	.82	30	1.00
				31	1.82

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.88	1.44	1.47	1.20	1.41	1.02	2.00	0.89	1.30	1.90	0.59	1.24
2	1.24	2.68	1.05	1.03	1.70	1.32	1.48	1.04	1.85	1.57	.58	1.05
3	1.30	2.25	.91	1.18	1.28	2.21	1.90	1.00	1.28	1.70	.57	.95
4	2.28	2.27	.89	1.01	1.21	3.10	1.64	.82	1.28	1.90	.54	.97
5	1.78	1.79	.87	.83	1.30	1.97	1.55	.84	1.10	1.72	.67	.93
6	1.32	4.00	.79	.81	1.32	2.08	1.66	.78	1.00	1.60	.70	1.21
7	1.24	2.00	.78	.82	1.60	3.52	1.55	.72	1.80	1.95	.80	1.32
8	1.05	4.00	.72	.78	1.48	2.18	1.52	.69	2.45	1.75	1.75	2.19
9	1.00	6.50	.69	.78	2.95	2.64	1.50	.69	1.57	1.51	.79	1.25
10	2.42	3.48	.81	.76	2.10	2.45	1.61	.67	1.27	1.48	.67	1.10
11	2.00	1.95	.69	.74	1.60	1.65	1.80	.77	2.22	1.30	.67	1.06
12	1.87	1.52	.67	.74	1.38	1.57	1.86	.79	1.42	1.24	.61	1.00
13	2.00	1.35	.64	.65	1.56	1.62	1.58	1.18	1.38	1.10	1.72	1.27
14	1.37	1.32	1.00	.60	2.23	1.55	1.49	.83	1.30	1.02	2.24	2.30
15	1.20	1.25	.98	.58	2.95	1.45	1.79	.70	1.70	1.02	1.65	1.00
16	1.31	1.18	.81	.52	1.84	1.68	1.55	1.70	1.63	1.00	1.31	2.08
17	1.10	1.08	.76	1.65	1.78	1.44	1.38	1.58	1.61	1.12	2.50	2.10
18	1.02	1.00	.68	1.60	1.55	1.41	1.27	1.26	1.71	.84	1.52	2.14
19	.93	.92	2.50	1.41	1.36	1.65	1.15	2.90	1.42	.81	2.00	2.07
20	.89	1.25	.82	1.50	1.60	1.48	1.24	1.34	2.09	.80	1.88	1.85
21	.88	.89	.79	3.20	1.71	1.70	1.15	.99	1.69	.86	2.22	1.48
22	.88	.89	.90	1.83	2.45	1.48	1.19	.80	2.20	.80	2.07	1.30
23	.80	.80	.77	5.50	1.51	1.31	1.38	.82	2.50	.78	1.78	1.25
24	1.89	1.28	.75	3.00	1.40	1.33	1.05	1.95	2.75	.76	1.55	1.30
25	1.48	1.00	.82	2.83	1.35	1.38	.89	1.85	1.75	.78	1.41	1.08
26	1.31	.90	.78	2.37	1.45	1.79	.88	1.55	2.19	.78	1.30	.96
27	2.12	3.22	.91	1.72	1.42	1.67	.89	1.40	2.30	.70	1.22	.96
28	2.40	2.23	.81	1.40	1.37	1.60	.80	1.25	2.83	.67	2.18	1.00
29	1.34	.....	.74	1.28	2.60	1.51	.79	3.60	1.80	.63	1.41	1.08
30	1.22	.....	.99	1.24	1.23	1.49	.79	2.00	5.58	.66	1.32	1.12
31	1.67	.....	1.18	.....	1.18	.....	.78	1.60	.....	.62	.....	1.10

NOTE.—Gage was read but once a day, the reading being taken in the afternoon.

Daily discharge, in second-feet, of Puohakamoa Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	30
2		12		22	30
3		13		23	30
4		14		24	390
5		15		25	a 580
6		16		26	770
7		17		27	90
8		18	24	28	60
9		19	24	29	48
10		20	24	30	37
				31	115

Daily discharge, in second-feet, of Puohakamoa Stream near Huelo, Maui, for 1910–11— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	128	74	74	52	69	37	142	30	60	128	13	56
2	56	264	40	40	102	60	79	40	122	84	13	40
3	60	182	30	52	60	173	128	37	60	102	10	34
4	190	182	30	37	52	346	96	24	60	128	10	34
5	115	115	27	27	60	135	84	27	44	102	16	34
6	60	550	24	24	60	157	96	24	37	90	18	52
7	56	142	24	24	90	434	84	18	115	135	24	60
8	40	550	18	24	79	157	79	18	217	108	108	173
9	37	900	18	24	314	254	79	18	84	79	24	56
10	208	434	24	21	157	217	90	16	56	79	16	44
11	142	135	18	21	90	96	115	21	173	60	16	40
12	122	79	16	21	69	84	122	24	69	56	13	37
13	142	64	16	16	84	90	90	52	69	44	102	56
14	64	60	37	13	182	84	79	27	60	37	182	190
15	52	56	37	13	314	74	115	18	102	37	96	37
16	60	52	24	8	122	102	84	102	96	37	60	157
17	44	44	21	96	115	74	69	90	90	44	226	157
18	37	37	18	90	84	69	56	56	102	27	79	165
19	34	30	226	69	64	96	48	304	69	24	142	150
20	30	56	24	79	90	79	56	199	157	24	128	122
21	30	30	24	368	102	102	48	37	102	27	173	79
22	30	30	30	122	217	79	52	24	173	24	157	60
23	24	24	21	800	79	60	69	24	226	24	115	56
24	128	60	21	325	69	64	40	135	274	21	84	60
25	79	37	24	294	64	69	30	122	108	24	69	44
26	60	30	24	199	74	115	30	84	173	24	60	34
27	157	368	30	102	69	96	30	69	190	18	52	34
28	208	182	24	69	64	90	24	56	294	16	173	37
29	64	.....	21	60	245	79	24	456	115	16	69	44
30	52	.....	37	56	56	79	24	142	810	16	60	44
31	96	.....	52	.....	52	.....	24	90	.....	13	.....	44

[a] Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve that is poorly defined, it being only approximate above 50 second-feet. Discharge applied to nearest half-tenth of gage height.

Monthly discharge of Puohakamoa Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	770	24	161	4,470	D.
1911.					
January	208	24	84.0	5,160	D.
February	900	24	170	9,440	D.
March	226	16	34.0	2,090	D.
April	800	13	105	6,250	D.
May	314	52	108	6,640	D.
June	434	37	122	7,260	D.
July	142	24	70.5	4,330	D.
August	456	16	76.9	4,730	D.
September	810	37	144	8,570	D.
October	135	13	53.2	3,270	C.
November	226	10	76.9	4,580	D.
December	190	34	71.9	4,420	D.
The year	900	10	92.1	66,700	

NOTE.—These estimates include the flow of Spreckels ditch. To obtain the flow of Puohakamoa Stream subtract the flow of Spreckels ditch at station No. 4.

ALO STREAM NEAR HUELO, MAUI.

Alo Stream is one of the small streams intercepted by the East Maui ditches. It is tributary to Waikamoi Stream from the east a short distance below the Alo Division weir. Spreckels ditch enters this stream a short distance above the weir and about 50 feet below the trail bridge crossing.

The gaging station on this stream was established December 18, 1910, at the bridge just above the point at which Spreckels ditch drops into the stream. This station is about 5 miles southeast of Kailua (Huelo post office).

The gage is fastened to the left bank just below the bridge.

Records at this station show the total flow of the stream but do not include water from the ditch.

Discharge measurements of Alo Stream near Huelo, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 16	C. H. Pierce	8.5	7.7	1.56	2.20
1911.					
Jan. 22	do	8.0	6.8	1.55	2.08
Nov. 10	J. B. Stewart	3.9	2.0	1.48	1.38
17	do	13.0	33.6	2.40	41.1
22	do	14.0	12.7	2.10	13.6

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Alo Stream near Huelo Maui, for 1910–11.

[Tokunaga, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910		1910		1910	
1		11		21	1.54
2		12		22	1.70
3		13		23	1.56
4		14		24	3.12
5		15		25	2.20
6		16		26	3.24
7		17		27	2.30
8		18	1.52	28	1.93
9		19	1.55	29	1.82
10		20	1.54	30	1.74
				31	1.84

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.88	2.08	1.87	1.83	1.88	1.70	1.93	1.60	1.90	2.14	1.38	1.84
2	1.90	2.74	1.77	2.10	1.97	1.96	1.92	1.84	1.94	2.04	1.38	1.70
3	1.80	2.32	1.67	1.85	1.87	2.24	1.92	1.69	1.92	2.08	1.36	1.60
4	1.98	2.44	1.61	1.70	1.84	2.20	2.01	1.63	1.92	2.10	1.34	1.69
5	2.61	2.11	1.56	1.61	1.80	2.30	1.91	1.64	1.74	2.02	1.35	1.62
6	1.90	3.02	1.52	1.57	1.88	2.01	2.00	1.52	1.70	1.98	1.52	1.50
7	1.86	2.38	1.50	1.57	1.84	2.65	1.96	1.50	2.04	2.33	1.51	1.90
8	1.82	2.50	1.50	1.51	1.80	2.00	1.94	1.50	2.10	2.10	1.95	2.12
9	1.72	2.49	1.48	1.50	2.56	2.05	1.92	1.50	2.04	2.00	1.54	1.88
10	2.24	3.64	1.58	1.48	2.49	2.34	1.96	1.42	1.94	1.99	1.46	1.78
11	2.16	2.01	1.51	1.48	1.92	1.98	2.10	1.42	2.60	1.82	1.43	1.70
12	2.18	1.92	1.44	1.46	1.90	1.92	2.12	1.52	2.07	1.80	1.39	1.69
13	2.18	1.88	1.41	1.41	1.98	2.09	1.98	1.83	1.99	1.77	2.13	1.90
14	1.90	1.84	1.76	1.40	2.83	2.05	1.92	1.53	1.91	1.70	2.19	2.04
15	1.86	1.70	1.74	1.39	2.33	1.91	2.16	1.50	1.96	1.68	2.06	2.18

Daily gage height, in feet, of Alo Stream near Huelo Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
16	1.85	1.70	1.56	1.38	2.29	1.95	1.98	2.02	1.91	1.64	1.84	1.99
17	1.84	1.68	1.50	2.07	1.91	1.90	1.90	1.89	1.94	1.86	2.48	2.00
18	1.73	1.66	1.50	2.10	1.96	1.90	1.84	1.70	2.20	1.60	2.04	2.01
19	1.64	1.61	1.85	1.90	1.89	1.92	1.79	2.50	1.95	1.58	2.08	2.04
20	1.60	1.60	1.74	1.94	1.96	1.91	1.86	1.90	2.38	1.53	1.99	2.00
21	1.59	1.58	1.59	2.47	2.24	2.11	1.76	1.74	2.12	1.57	2.34	1.92
22	1.58	1.58	1.79	1.92	2.24	1.94	1.80	1.70	2.42	1.52	2.20	1.90
23	1.54	1.54	1.53	2.55	1.98	1.86	1.86	1.68	2.38	1.50	2.13	1.86
24	2.24	1.70	1.51	1.98	1.88	1.86	1.72	2.04	2.19	1.48	2.11	1.92
25	1.95	1.68	1.53	2.22	1.83	1.87	1.64	2.10	2.00	1.49	1.96	1.78
26	1.88	1.64	1.76	2.45	1.88	1.91	1.61	2.08	2.40	1.50	1.89	1.72
27	2.24	2.35	1.66	2.07	1.86	1.91	1.65	1.92	2.24	1.49	1.82	1.69
28	2.62	2.02	1.58	2.00	1.81	1.97	1.60	1.90	2.29	1.48	2.28	1.67
29	1.90	.....	1.50	1.89	1.85	1.91	1.56	2.70	2.09	1.46	1.94	1.93
30	1.84	.....	1.60	1.89	1.81	1.89	1.58	2.32	3.18	1.44	1.88	1.84
31	2.03	.....	1.89	.....	1.80	.....	1.53	1.98	.....	1.42	.....	1.85

Daily discharge, in second-feet, of Alo Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	.....	11	.....	21	1.9
2	.....	12	.....	22	4.0
3	.....	13	.....	23	2.1
4	.....	14	.....	24	58
5	.....	15	.....	25	17
6	.....	16	.....	26	68
7	.....	17	.....	27	20
8	.....	18	1.7	28	9
9	.....	19	2.0	29	6
10	.....	20	1.9	30	5
				31	7

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	8	14	8	6	8	4	9	2.5	8	15	0.3	7
2	8	37	5	14	10	10	8	7	9	12	0.3	4
3	6	20	4.0	7	7	18	8	3.8	8	14	0.2	2.5
4	11	24	2.6	4	7	11	11	2.9	8	14	0.1	3.8
5	31	14	2.1	2.6	6	20	8	3.1	5	11	0.2	2.8
6	8	51	1.7	2.2	8	11	11	1.7	4	10	1.7	2.1
7	7	22	1.5	2.2	7	33	10	1.5	12	21	1.6	8
8	6	27	1.5	1.6	6	11	9	1.5	14	14	10	14
9	4.4	27	1.3	1.5	29	13	8	1.5	12	11	1.9	8
10	18	82	2.3	1.3	27	21	10	.7	8	8	1.1	6
11	16	11	1.6	1.3	8	11	14	.7	31	6	.8	4
12	17	8	0.9	1.1	8	8	14	1.7	13	6	.4	3.8
13	17	8	0.6	.6	11	14	11	6	11	5	15	8
14	8	7	5	.5	41	12	8	1.8	8	4	17	12
15	7	4	5	.4	21	8	16	1.5	10	3.7	13	16
16	7	4	2.1	.3	20	10	11	11	8	3.1	7	11
17	7	3.7	1.5	13	8	8	8	8	9	7	26	11
18	4.6	3.2	1.5	14	10	8	7	4	17	2.5	12	11
19	3.1	2.6	7	8	8	8	6	27	9	2.3	14	13
20	2.5	2.5	5	9	10	8	7	8	22	1.8	11	11
21	2.4	2.3	2.4	26	18	14	5	5	15	1.9	21	8
22	2.3	2.3	6	8	18	9	6	4	24	1.7	17	8
23	1.9	1.9	1.8	29	11	7	7	4	22	1.5	15	7
24	18	4.0	1.6	11	8	7	4	12	17	1.3	14	8
25	9	3.6	1.8	18	6	7	3.1	14	11	1.4	10	6
26	8	3.1	5	25	8	8	2.6	14	23	1.5	8	4
27	18	22	3.4	13	7	8	3.2	8	18	1.4	6	3.8
28	32	11	2.3	11	6	10	2.5	8	20	1.3	19	3.5
29	8	.....	1.5	8	7	8	2.1	35	14	1.1	9	9
30	7	.....	2.5	8	6	8	2.3	20	60	.9	8	7
31	12	.....	8	.....	6	.....	1.8	11	.....	.7	.....	7

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 25 second-feet.

Monthly discharge of Alo Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	68	1.7	14.5	403	B.
1911.					
January	32	1.9	10.2	627	B.
February	82	1.9	15.1	839	B.
March	8	0.6	3.11	191	B.
April	29	0.3	8.25	491	B.
May	41	6.0	11.6	713	B.
June	33	4.0	11.1	660	B.
July	16	1.8	7.54	464	B.
August	35	0.7	7.45	458	B.
September	60	4.0	15.0	893	B.
October	21	0.7	6.00	369	B.
November	26	0.1	8.69	517	B.
December	16	2.1	7.43	457	B.
The year	82	0.1	9.22	6,680	

WAIKAMOI STREAM NEAR HUELO, MAUI.

Waikamoi is one of the fairly large streams intercepted by the East Maui ditches. It is the first large stream west of Puohakamoa.

A gaging station was established on this stream December 16, 1910, about 4½ miles southeast of Kailua (Huelo post office), and just above the bridge on the Spreckels ditch trail a few hundred feet above the point of inflow of Spreckels ditch.

The gage is fastened to rocks in the stream bed about 50 feet above the bridge. The stream bed is exceedingly rough and only low-water measurements have been made. A few hundred feet below the gage Spreckels ditch takes out again.

The discharge at this station gives the total flow of the stream above all diversions.

Water in excess of what Spreckels ditch takes passes down the stream to Center ditch at a lower elevation.

Discharge measurements of Waikamoi Stream near Huelo, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Dec. 16	C. H. Pierce	4.0	20.7	1.63	7.7
1911.					
Jan. 22	do	7.8	19.0	1.62	6.8
Nov. 1	J. B. Stewart	4.9	4.5	1.37	2.3
Dec. 13	do	7.0	12.2	1.78	12.5

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Waikamoi Stream near Huelo, Maui, for 1910–11.

[Tokunaga, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
18	1.60	23	1.62	28	1.83
19	1.60	24	2.26	29	1.73
20	1.60	25	2.15	30	1.69
21	1.59	26	3.23	31	1.96
22	1.70	27	2.20		

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.94	2.12	1.88	1.79	1.88	1.68	1.94	1.56	1.74	2.16	1.32	1.72
2	1.82	3.00	1.92	1.94	2.02	1.78	1.88	1.14	1.84	1.98	1.32	1.66
3	1.70	2.51	1.64	1.92	1.92	2.00	1.78	1.54	1.76	1.94	1.30	1.62
4	2.70	2.44	1.60	1.72	1.85	2.17	2.06	1.53	1.74	2.12	1.28	1.64
5	2.82	2.18	1.58	1.64	1.98	2.42	1.86	1.56	1.66	2.12	1.29	1.60
6	2.22	2.92	1.56	1.59	1.92	2.12	1.94	1.50	1.60	1.98	1.32	1.82
7	1.93	2.28	1.54	1.56	1.88	3.24	2.00	1.49	2.06	2.36	1.47	1.69
8	1.79	4.55	1.53	1.53	1.78	2.54	1.88	1.43	2.68	2.09	1.66	2.18
9	1.72	5.10	1.52	1.50	3.52	2.68	1.80	1.44	1.94	1.94	1.58	1.72
10	2.80	5.61	1.60	1.49	2.71	2.77	1.94	1.40	1.78	1.82	1.43	1.68
11	2.26	2.56	1.53	1.49	1.96	2.04	1.98	1.40	2.98	1.74	1.39	1.64
12	2.20	2.05	1.50	4.47	1.88	1.80	2.06	1.46	2.10	1.70	1.32	1.60
13	2.32	1.92	1.48	1.44	1.94	2.06	1.41	1.72	1.82	1.66	1.81	1.78
14	1.92	1.82	1.60	1.44	3.74	1.96	1.85	1.52	1.74	1.62	2.54	2.94
15	1.79	1.96	1.78	1.40	2.96	1.86	1.88	1.48	1.82	1.62	2.06	2.18
16	1.78	1.72	1.60	1.38	2.41	1.99	1.88	1.96	1.77	1.60	1.74	2.91
17	1.78	1.68	1.56	2.21	2.02	1.87	1.78	1.89	1.78	1.68	2.70	2.58
18	1.75	1.64	1.53	1.89	2.06	1.82	1.88	1.70	2.20	1.58	2.07	2.95
19	1.69	1.26	2.16	1.80	1.88	1.96	1.62	3.42	1.84	1.54	2.16	2.76
20	1.65	1.65	1.76	1.88	1.88	1.85	1.66	1.85	2.76	1.51	2.32	1.76
21	1.64	1.62	1.62	2.83	2.12	2.06	1.62	1.80	2.06	1.50	2.62	1.87
22	1.62	1.58	1.68	2.44	2.34	1.82	1.62	1.62	2.51	1.50	2.46	1.81
23	1.61	1.54	1.59	1.80	1.94	1.78	1.70	1.60	2.32	1.48	2.15	1.74
24	1.92	1.59	1.54	2.90	1.84	1.66	1.62	2.06	2.16	1.46	2.09	1.76
25	1.94	1.60	1.58	3.01	1.76	1.74	1.57	2.00	2.02	1.46	1.86	1.69
26	1.81	1.60	1.59	2.98	1.81	1.97	1.55	2.03	2.46	1.48	1.74	1.66
27	2.24	1.92	1.66	2.10	1.80	2.00	1.56	1.74	2.29	1.42	1.70	1.66
28	2.88	2.72	1.59	1.59	1.82	1.86	1.54	1.71	3.35	1.40	2.51	1.63
29	1.92	.....	1.51	1.80	2.60	1.77	1.52	2.88	2.14	1.40	2.02	1.84
30	1.79	.....	1.55	1.70	1.82	1.74	1.52	3.20	3.84	1.39	1.82	1.64
31	2.08	.....	2.06	.....	1.76	.....	1.50	1.86	.....	1.36	.....	1.70

Daily discharge, in second-feet, of Waikamoi Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	.....	11	.....	21	7
2	.....	12	.....	22	9
3	.....	13	.....	23	7
4	.....	14	.....	24	25
5	.....	15	.....	25	22
6	.....	16	.....	26	76
7	.....	17	.....	27	23
8	.....	18	7	28	12
9	.....	19	7	29	10
10	.....	20	7	30	9
				31	16

Daily discharge, in second-feet, of Waikamoi Stream near Huelo, Maui, for 1910–11—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	15	20	14	11	14	9	15	6	10	22	1.7	9
2	11	60	9	10	17	11	14	10	12	17	1.7	8
3	9	35	8	14	14	17	11	6	10	15	1.5	7
4	45	23	7	9	12	22	19	6	10	20	1.3	8
5	52	33	7	8	11	31	13	6	8	20	1.4	7
6	24	56	6	7	14	20	15	5	7	17	5	11
7	15	27	6	6	14	23	17	5	19	29	4	9
8	11	164	6	6	11	37	14	4	45	20	8	22
9	9	199	5	5	88	45	11	4	15	15	7	9
10	50	234	7	5	45	48	15	3	11	11	4	9
11	25	37	6	5	16	18	17	3	60	10	2.8	8
12	23	18	5	154	14	11	19	4	20	9	1.7	7
13	28	14	5	4	16	19	3	9	11	8	11	11
14	14	12	7	4	104	16	12	5	10	7	37	57
15	11	10	11	3	58	13	14	5	11	7	19	50
16	11	9	7	3	31	17	14	16	10	7	9	55
17	11	9	6	23	17	13	11	14	11	9	45	40
18	10	8	6	14	19	11	9	9	23	7	19	58
19	9	1.1	21	11	14	16	7	82	12	6	22	48
20	8	8	10	14	14	13	8	12	48	5	27	10
21	8	7	7	52	20	19	7	11	19	5	40	13
22	7	7	9	33	29	11	7	7	35	5	33	11
23	7	6	6	11	15	11	9	7	27	5	22	10
24	14	7	6	55	12	8	7	19	22	4	20	10
25	15	7	7	60	10	10	6	17	17	4	13	9
26	11	7	7	60	11	16	6	18	33	5	10	8
27	25	14	8	20	11	17	6	10	27	3	9	8
28	54	46	7	14	11	13	6	9	29	3	35	8
29	15	.....	5	11	40	10	5	55	21	3	17	12
30	11	.....	6	10	11	10	5	70	111	2.8	11	8
31	20	.....	19	.....	10	.....	5	13	.....	2.2	.....	9

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 20 second-feet.

Monthly discharge of Waikamoi Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	76	7	16.9	469	C.
1911.					
January	54	7	18.6	1,140	C.
February	234	1.1	38.5	2,140	D.
March	21	5	7.94	488	B.
April	154	3	21.4	1,270	C.
May	104	10	23.3	1,430	C.
June	48	8	17.8	1,060	B.
July	19	3	10.5	646	B.
August	82	3	14.5	892	B.
September	111	7	23.5	1,400	C.
October	29	2.2	9.77	601	B.
November	45	1.3	14.6	869	C.
December	58	7	17.7	1,090	C.
The year	234	1.1	18.0	13,000	

OOPUOLA STREAM NEAR HUELO, MAUI.

Oopuola Stream is a small stream west of Waikamoi and east of Nailiilihaele. Its water is intercepted by Spreckels and Center ditches.

A gaging station was established on this stream December 16, 1910, where the Spreckels ditch trail crosses the stream about 2 miles southeast of Kailua (Huelo post office).

A staff gage, graduated to tenths of a foot, is fastened to the right bank 15 feet above the bridge.

The discharge at this station gives the total flow of the stream above all diversions.

Discharge measurements of Oopuola Stream near Huelo, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 16	C. H. Pierce	13.5	7.2	1.22	2.6
1911.					
Nov. 1	J. B. Stewart			1.00	.92
11	.....do	3.5	2.3	1.17	1.86
13	.....do	7.7	5.7	1.77	8.7

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Oopuola Stream near Huelo, Maui, for 1910–11.

[Joseph Elferreira and John Pachero, observers.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	1.17
2		12		22	1.23
3		13		23	1.25
4		14		24	1.58
5		15		25	
6		16	1.22	26	3.10
7		17	1.2	27	2.9
8		18	1.18	28	1.8
9		19	1.2	29	1.2
10		20	1.19	30	1.19
				31	2.6

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1		2.30	2.10	1.53	1.32	1.17	1.52	1.10	1.38		1.00	1.32
2	1.22	2.87	1.60		1.39		1.50	1.10	1.50	1.10	1.00	1.30
3	1.40	1.90	1.30	1.36	1.34	1.90	1.40	1.20		1.12	.99	
4	2.70	2.40	1.27	1.22				1.15	1.40	1.08	.98	1.33
5	1.82	1.84	1.24	1.18	1.28	1.90	1.50	1.10	1.32	1.08		1.31
6	1.50	3.20	1.21	1.16	1.29	1.73	1.55		1.30	1.40	1.04	1.80
7	1.33	1.95	1.19	1.15		2.85	1.35	1.10	1.70	1.55	1.10	1.40
8	1.30	3.10	1.17	1.14	1.26	2.06	1.51	1.08	2.50		2.10	2.10
9	1.27	4.50	1.17		3.04	2.10		1.09	1.50	1.51	1.14	1.41
10	1.82	4.80	1.21	1.13	2.50	1.95	1.50	1.07		1.50	1.10	
11		1.85	1.14	1.13	1.70		1.55	1.07	2.00	1.40	1.15	1.30
12	1.90	1.62	1.10	1.12	1.62	1.34	2.00	1.09	1.70	1.30	1.10	1.31
13	1.87	1.50	1.08	1.11	1.58	1.52	1.52		1.50	1.30	2.10	1.31
14	1.58	1.42	1.23	1.11		1.40	1.54	1.10	1.36	1.29	2.08	1.81
15	1.40	1.32	1.38	1.09	2.00	1.63	2.20	1.10	1.45		1.76	1.50
16	1.33	1.28	1.28	1.08	1.91			1.38	1.31	1.20	1.40	1.34
17	1.34	1.26	1.22	1.40	1.65	1.57	1.50	1.60			2.85	
18	1.28	1.23	1.18	1.34	1.68		1.42	1.60	1.75	1.13	1.70	1.44
19	1.25	1.20	1.93	1.29	1.46	1.51	1.30	2.70	1.49	1.11		1.45
20	1.21	1.18	1.25	1.26	1.35	1.46	1.30		2.50	1.09	1.40	1.50

Daily gage height, in feet, of Oopuola Stream near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
21	1.19	1.17	1.20	2.10	.....	2.00	1.30	1.55	2.05	1.09	1.90	1.43
22	.....	1.16	1.28	2.80	1.94	1.65	1.30	1.30	1.80	.....	1.81	1.40
23	1.17	1.15	1.22	.....	1.50	1.50	.....	1.20	3.50	1.05	1.56	1.31
24	2.48	1.22	1.19	1.90	1.42	1.46	1.20	1.70	.....	1.04	1.70	.....
25	1.82	1.20	1.20	2.05	1.38	.....	1.10	1.85	2.00	1.04	1.41	.....
26	1.80	1.18	.....	2.50	1.42	1.55	1.08	1.45	2.60	1.10	.....	1.30
27	2.85	3.20	1.25	1.30	1.39	1.90	1.10	.....	2.10	1.08	1.22	1.31
28	2.60	2.80	1.20	1.18	.....	1.72	1.10	1.40	2.30	1.07	2.20	1.29
29	1.84	.....	1.17	1.16	1.25	1.53	1.10	4.00	1.70	.....	1.40	1.31
30	1.38	.....	1.19	.....	1.20	.....	1.00	2.00	3.00	1.01	1.42	1.40
31	.....	.....	2.05	.....	1.18	.....	1.05	1.58	.....	1.00	.....	.....

NOTE.—Gage was read but once a day, the reading being taken in the afternoon.

Daily discharge, in second-feet, of Oopuola Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	.....	11	.....	21	1.6
2	.....	12	.....	22	2.0
3	.....	13	.....	23	2.2
4	.....	14	.....	24	5.9
5	.....	15	.....	25	a 28
6	.....	16	1.8	26	51
7	.....	17	1.8	27	42
8	.....	18	1.8	28	10
9	.....	19	1.8	29	1.8
10	.....	20	1.8	30	1.7
				31	30

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	a 16	21	16	5.5	2.6	1.5	4.8	1.2	3.6	a 24	0.8	2.6
2	1.8	41	6.4	a 4.3	3.6	a 6.8	4.8	1.2	4.8	1.2	.8	2.6
3	3.6	12	2.6	3.1	3.1	12	3.6	1.8	a 4.2	1.2	.8	a 2.8
4	34	24	2.2	1.8	a 2.8	a 12	a 4.2	1.5	3.6	1.2	.8	3.1
5	10	11	2.1	1.8	2.6	12	4.8	1.2	2.6	1.2	a .9	2.6
6	4.8	56	1.8	1.5	2.6	9.0	5.5	a 1.2	2.6	3.6	1.0	10
7	3.1	13	1.8	1.5	a 2.4	40	3.1	1.2	8.0	5.5	1.2	3.6
8	2.6	51	1.5	1.5	2.2	15	4.8	1.2	27	a 5.2	16	16
9	2.4	144	1.5	a 1.5	48	16	a 4.8	1.2	4.8	4.8	1.5	3.6
10	10	168	1.8	1.5	27	13	4.8	1.0	a 9.4	4.8	1.2	a 3.1
11	a 11	11	1.5	1.5	8.0	a 8.0	5.5	1.0	14	3.6	1.5	2.6
12	12	6.4	1.2	1.2	6.4	3.1	14	1.2	8	2.6	1.2	2.6
13	11	4.8	1.2	1.2	6.4	4.8	4.8	a 1.2	4.8	2.6	16	2.6
14	6.4	3.8	2.2	1.2	a 10	3.6	5.5	1.2	3.1	2.6	16	10
15	3.6	2.6	3.6	1.2	14	7.2	18	1.2	4.2	a 2.2	9.0	4.8
16	3.1	2.6	2.6	1.2	12	a 6.4	a 11	3.6	2.6	1.8	3.6	3.1
17	3.0	2.2	1.8	3.6	7.2	5.5	4.8	6.4	a 5.8	a 1.6	40	a 3.6
18	2.6	2.0	1.8	3.1	8.0	a 5.2	3.6	6.4	9.0	1.5	8.0	4.2
19	2.2	1.8	13	2.6	4.2	4.8	2.6	34	4.8	1.2	a 5.8	4.2
20	1.8	1.8	2.2	2.2	3.1	4.2	2.6	a 20	27	1.2	3.6	4.8
21	1.8	1.6	1.8	16	a 8.0	14	2.6	5.5	15	1.2	12	4.2
22	a 1.6	1.6	2.6	38	13	7.2	2.6	2.6	10	a 1.1	10	3.6
23	1.6	1.5	1.8	a 25	4.8	4.8	a 2.2	1.8	74	1.0	5.5	2.6
24	26	1.8	1.8	12	3.6	4.2	1.8	8.0	a 44	1.0	8.0	a 2.6
25	10	1.8	1.8	15	3.6	a 4.8	1.2	11	14	1.0	3.6	a 2.6
26	10	1.8	a 2.0	27	3.6	5.5	1.2	4.2	30	1.2	a 2.7	2.6
27	40	56	2.2	2.6	3.6	12	1.2	a 3.9	16	1.2	1.8	2.6
28	30	38	1.8	1.8	a 2.9	8.0	1.2	3.6	21	1.0	18	2.6
29	11	.....	1.5	1.5	2.2	5.5	1.2	107	8.0	a .9	3.6	2.6
30	3.6	.....	1.8	a 2.0	1.8	a 5.2	.8	14	46	.8	3.6	3.6
31	a 12	.....	15	.....	1.8	.....	1.0	6.4	.....	.8	.....	a 3.6

a Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 20 second-feet. Discharge applied to nearest half-tenth of gage height.

Monthly discharge of Oopuola Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet)	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 16–31	51	1.6	11.6	368	C.
1911.					
January	40	1.6	9.44	580	B.
February	168	1.5	24.4	1,360	C.
March	16	1.2	3.32	204	B.
April	38	1.2	6.13	365	B.
May	48	1.8	7.26	446	B.
June	40	1.5	8.71	518	B.
July	18	.8	4.34	267	B.
August	107	1.0	8.29	510	B.
September	74	2.6	14.4	857	B.
October	[a] 24	.8	2.74	168	B.
November	40	.8	6.62	394	B.
December	16	2.6	4.05	249	B.
The year	168	0.8	8.17	5,920	

[a] Interpolated.

SPRECKELS DITCH AT STATION NO. 1, NEAR HUELO, MAUI.

Spreckels ditch heads in the Nuaailua Stream east of Honomanu Stream. Eight gaging stations have been placed on this ditch between its source and the reservoir near Kailua.

Station No. 1, which is at the trail crossing of Ulawina Stream, was established December 18, 1910.

A staff gage, graduated to tenths of a foot, is placed at the mouth of the tunnel on the right or makai side, just east of Ulawina Stream.

The discharge at this station gives the amount of water collected by the ditch above, and represents the total combined flow of Nuaailua and Honomanu streams at low and medium stages.

Discharge measurements of Spreckels ditch at station No. 1, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 20	C. H. Pierce	5.6	6.2	0.48	8.5
Apr. 3	do	6.0	7.9	.60	10.3
Nov. 16	J. B. Stewart	6.2	8.0	.60	9.7
20	do	7.9	23.8	1.45	31.2

Daily gage height, in feet, of Spreckels ditch at station No. 1, near Huelo, Maui, for 1910–11.

[Tom Pahukoa and Kumagai, observers.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	0.45
2		12		22	.75
3		13		23	.5
4		14		24	1.8
5		15		25	2.0
6		16		26	2.0
7		17		27	1.5
8		18	0.4	28	.95
9		19	.5	29	.75
10		20	.4	30	.65
				31	

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.4	1.8	1.1	0.8	0.65	0.6	1.8	0.6	0.8	1.65	0.25	0.65
2	1.1	2.05	.65	1.2	1.8	.95	1.5	.8	1.2	1.1	.25	.55
3	1.1	1.95	.5	.7	1.2	1.7	1.3	.7	.85	1.4	.25	.5
4	1.8	2.05	.5	.55	.9	1.6	1.7	.8	.9	1.6	.2	.55
5	1.65	1.45	.45	.5	.9	1.95	1.5	.6	.65	1.55	.2	.5
6	1.2	2.05	.4	.45	1.7	1.7	1.6	.4	.6	1.35	.45	1.05
7	1.05	1.7	.35	.45	1.2	2.05	1.5	.4	1.4	1.85	.45	.7
8	.9	2.1	.35	.4	1.25	1.8	1.55	.3	1.7	1.65	.8	1.7
9	.65	2.15	.35	.35	2.2	1.8	1.55	.35	1.3	1.25	.45	.75
10	1.85	2.35	.45	.35	2.1	1.8	1.7	.3	.8	1.5	.35	.65
11	1.75	.9	.4	.3	1.3	1.6	1.85	.35	1.9	.8	.3	.5
12	1.65	.8	.35	.3	1.35	1.4	1.6	.45	1.35	.7	.25	.55
13	1.85	.65	.3	.3	1.3	1.7	1.5	.9	.95	.6	1.25	.95
14	1.1	.7	.65	.25	1.95	1.7	1.6	.4	.8	.6	1.6	1.9
15	.85	.8	.7	.25	2.2	1.2	1.8	.45	1.15	.6	1.35	1.6
16	.85	.7	.4	.2	1.85	1.4	1.6	1.7	.95	.5	.65	1.3
17	.85	.65	.35	1.5	1.6	1.3	.95	1.5	1.3	.9	1.8	1.5
18	.7	.6	.3	1.65	1.45	1.6	.8	1.7	1.6	.5	1.3	1.75
19	.55	.5	.85	1.55	1.2	1.75	.7	1.9	1.1	.45	1.5	1.6
20	.5	.55	.6	1.3	1.4	1.5	1.2	1.1	1.6	.4	1.6	1.4
21	.5	.5	.8	1.6	1.95	1.7	.7	.65	1.3	.45	1.95	1.1
22	.5	.4	.65	1.55	1.75	1.4	.8	.6	1.9	.4	1.85	.95
23	.45	.4	.4	2.1	1.5	.9	1.25	.55	1.7	.35	1.7	.75
24	1.2	1.05	.4	1.9	1.1	.9	.7	1.6	1.65	.35	1.6	.65
25	1.55	.7	.45	2.3	.95	1.2	.55	1.6	1.4	.35	1.0	.6
26	1.0	.6	.9	2.1	.95	1.6	.55	1.3	1.8	.45	.75	.5
27	1.95	1.1	.55	1.55	1.1	1.65	.6	.9	1.7	.35	.65	.5
28	1.9	1.9	.4	1.35	1.05	1.55	.5	.75	1.8	.3	1.8	.45
29	1.05	.....	.35	.95	1.1	.95	.5	1.45	1.55	.3	1.35	.9
30	.95	.....	.5	1.15	1.05	1.25	.5	1.5	2.1	.3	.85	.6
31	1.7	.....	1.05	.....	.85	.....	.4	1.0	.....	.3	.....	.7

[a] Discharge interpolated.

Daily discharge, in second-feet, of Spreckels ditch at station No. 1, near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	8.2
2		12		22	12
3		13		23	8.8
4		14		24	44
5		15		25	52
6		16		26	52
7		17		27	32
8		18	7.7	28	16
9		19	8.8	29	12
10		20	7.7	30	10
				31	[a]20

Daily discharge, in second-feet, of Spreckels ditch at station No. 1, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	29	44	20	13	11	10	44	10	13	38	6.3	11
2	20	54	11	23	44	16	32	13	23	20	6.3	9.4
3	20	50	8.8	11	23	40	26	11	14	29	6.3	8.8
4	44	54	8.8	9.4	15	36	40	13	15	36	5.9	9.4
5	38	30	8.2	8.8	15	50	32	10	11	34	5.9	8.8
6	23	54	7.7	8.2	40	40	36	7.7	10	28	8.2	18
7	18	40	7.2	8.2	23	54	32	7.7	29	46	8.2	11
8	15	56	7.2	7.7	24	44	34	6.7	40	38	13	40
9	10	58	7.2	7.2	60	44	34	7.2	26	24	8.2	12
10	46	66	8.2	7.2	56	44	40	6.7	13	32	7.2	10
11	42	15	7.7	6.7	26	36	46	7.2	48	13	6.7	8.8
12	38	13	7.2	6.7	28	29	36	8.2	28	11	6.3	9.4
13	46	10	6.7	6.7	26	40	32	15	16	10	24	16
14	20	11	10	6.3	50	40	36	7.7	13	10	36	48
15	14	13	11	6.3	60	23	44	8.2	22	10	28	36
16	14	11	7.7	5.9	46	29	36	40	16	8.8	11	26
17	14	10	7.2	32	36	26	16	32	26	15	44	32
18	11	10	6.7	38	30	36	13	40	36	8.8	26	42
19	9.4	8.8	14	34	23	42	11	48	20	8.2	32	36
20	8.8	9.4	10	26	29	32	23	20	36	7.7	36	29
21	8.8	8.8	13	36	50	40	11	10	26	8.2	50	20
22	8.8	7.7	10	34	42	29	13	10	48	7.7	46	16
23	8.2	7.7	7.7	56	32	15	24	9.4	40	7.2	40	12
24	23	18	7.7	48	20	15	11	36	38	7.2	36	10
25	34	11	8.2	64	16	23	9.4	36	29	7.2	17	10
26	17	10	15	56	16	36	9.4	26	44	8.2	12	8.8
27	50	20	9.4	34	20	38	10	15	40	7.2	10	8.8
28	48	48	7.7	28	18	34	8.8	12	44	6.7	44	8.2
29	18	.....	7.2	16	20	16	8.8	30	34	6.7	28	15
30	16	.....	8.8	22	18	24	8.8	32	56	6.7	14	10
31	40	.....	18	.....	14	.....	7.7	17	.....	6.7	.....	11

NOTE.—Daily discharge computed from a rating curve that is fairly well defined between 7 and 35 second-feet.

Monthly discharge of Spreckels ditch at station No. 1, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	52	7.7	20.8	578	B.
1911.					
January	50	8.2	24.3	1,490	B.
February	66	7.7	26.7	1,480	B.
March	20	6.7	9.52	585	A.
April	64	5.9	22.2	1,320	B.
May	60	11	30.0	1,840	B.
June	54	10	32.7	1,950	B.
July	46	7.7	24.7	1,520	B.
August	48	6.7	17.8	1,090	B.
September	56	10	28.5	1,700	B.
October	46	6.7	16.4	1,010	B.
November	50	5.9	20.8	1,240	B.
December	48	8.2	17.8	1,090	B.
The year	66	5.9	22.5	16,300	

SPRECKELS DITCH AT STATION NO. 2, NEAR HUELO, MAUI.

Station No. 2 on Spreckels ditch is 75 feet east of Kolea Stream No. 2 and about 7½ miles by trail southeast of Kailua (Huelo post office). It was established November 6, 1911.

A staff gage, graduated into tenths of feet, is fastened to the left bank and is used for obtaining gage heights. Between this station and station No. 1 water is taken into the ditch from Ulawina Stream and Kolea Stream No. 1.

Discharge measurements of Spreckels ditch at station No. 2, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 15	J. B. Stewart	7.4	10.1	1.65	25.2
20	.....do	7.3	12.2	1.86	35.1
Dec. 16	.....do	7.5	12.8	1.90	34.8

Daily gage height, in feet, of Spreckels ditch at station No. 2, near Huelo, Maui, for 1911.

[Kumagai, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	1.18	11	0.78	1.05	21	1.88	1.65
2	.....	1.10	12	.73	1.03	22	1.90	1.48
3	.....	1.10	13	1.73	1.38	23	1.90	1.28
4	.....	1.05	14	1.93	1.90	24	1.88	1.20
5	.....	1.00	15	1.60	1.78	25	1.45	1.13
6	0.90	1.30	16	1.13	1.93	26	1.25	1.03
7	.95	1.38	17	1.88	1.83	27	1.18	1.00
8	1.40	1.88	18	1.70	1.90	28	1.93	1.00
9	.90	1.25	19	1.90	1.90	29	1.68	1.28
10	.80	1.15	20	1.98	1.93	30	1.33	1.23
						31	.....	1.15

Daily discharge, in second-feet, of Spreckels ditch at station No. 2, near Huelo, Maui, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	11	11	2.9	7.9	21	35	25
2	.....	9	12	2.4	7.4	22	36	20
3	.....	9	13	28	16	23	36	14
4	.....	7.9	14	38	36	24	35	11
5	.....	6.8	15	23	30	25	18	10
6	4.8	14	16	10	37	26	12	7.4
7	5.8	16	17	35	32	27	11	6.8
8	17	35	18	27	36	28	38	6.8
9	4.8	12	19	36	36	29	26	14
10	3.2	10	20	40	37	30	15	12
						31	.....	10

NOTE.—Daily discharge computed from a rating curve that is fairly well defined between 20 and 40 second-feet.

Monthly discharge of Spreckels ditch at station No. 2, near Huelo, Maui, for Nov. 6 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 6–30	40	2.4	21.6	1,070	C.
December	37	6.8	17.5	1,080	C.

SPRECKELS DITCH AT STATION NO. 3, NEAR HUELO, MAUI.

Station No. 3 on Spreckels ditch, which is about 300 feet east of Haipuaena Stream and about 6¾ miles by trail southeast of Kailua (Huelo post office), was established December 18, 1910. A staff gage, graduated into tenths of feet is fastened to the left bank and is used to obtain gage heights. Measurements are made from a board about 100 feet below the gage.

The discharge at this station shows the quantity of water that is emptied into Haipuaena Stream by Spreckels ditch. Between this station and Station No. 2 the ditch receives inflow from Kolea streams Nos. 2 and 3.

Discharge measurements of Spreckels ditch at station No. 3, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 20	C. H. Pierce	4.9	5.6	1.28	13.6
Apr. 3	....do	5.3	6.7	1.50	17.9
Nov. 15	J. B. Stewart	5.1	9.7	2.16	31.0
Dec. 17	....do	5.8	9.8	2.30	34.5

Daily gage height, in feet, of Spreckels ditch at station No. 3, near Huelo, Maui, for 1910–11.

[Tom Pahukoa and Kumagai, observers.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	1.3
2		12		22	1.4
3		13		23	1.4
4		14		24	2.7
5		15		25	
6		16		26	2.7
7		17		27	2.3
8		18	1.1	28	1.9
9		19	1.3	29	1.4
10		20	1.1	30	1.33
				31	

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	2.2	2.67	1.87	1.65	1.89	1.45	2.20	1.35	1.75	2.23	1.00	1.60
2	2.07	2.69	1.52	2.47	1.98	2.05	2.15	1.63	2.30	2.25	.98	1.45
3	1.62	2.55	1.42	1.47	1.87	2.45	2.00	1.85	1.78	2.25	.98	1.45
4	2.24	2.68	1.34	1.35	1.90	2.35	2.35	1.28	1.88	2.30	.93	1.38
5	2.60	2.40	1.20	1.31	2.01	2.30	2.20	1.30	1.55	2.30	.95	1.33
6	2.11	2.70	1.17	1.28	2.07	2.25	2.23	1.73	1.43	2.25	.98	1.85
7	2.00	2.40	1.13	1.32	2.20	2.55	2.20	1.10	2.30	2.33	1.28	1.85
8	1.71	2.74	1.10	1.20	2.24	2.30	2.15	1.05	2.35	2.30	1.90	1.28
9	1.53	2.78	1.08	1.10	2.24	2.35	2.10	1.05	2.15	2.20	1.20	1.70
10	2.44	3.30	1.17	1.10	2.18	2.35	2.20	1.03	1.75	1.98	1.08	1.65
11	1.45	2.10	1.10	1.02	1.94	2.15	2.40	1.10	2.60	1.80	1.03	1.40
12	2.30	1.90	1.04	1.00	1.97	2.10	2.30	1.20	2.25	1.63	.98	1.40
13	2.35	1.64	1.01	.97	1.91	2.20	2.15	1.60	1.88	1.53	2.25	1.83
14	2.10	1.87	1.18	.83	2.24	2.15	2.10	1.20	1.83	1.43	2.30	2.43
15	1.82	1.75	1.24	.74	2.25	2.05	2.50	1.20	2.25	1.43	2.10	2.40
16	1.94	1.64	1.20	.87	2.10	2.25	2.15	1.25	1.90	1.40	1.50	2.28
17	1.70	1.55	1.18	1.94	2.10	2.10	1.90	2.15	2.28	1.65	2.35	2.28
18	1.57	1.44	1.14	1.93	2.32	2.15	1.75	2.18	2.28	1.33	2.18	2.30
19	1.40	1.39	1.84	2.61	1.92	2.20	1.60	2.33	2.10	1.28	2.28	2.30
20	1.25	1.49	1.34	2.20	2.45	2.10	1.75	1.90	2.30	1.20	2.22	2.30

Daily gage height, in feet, of Spreckels ditch at station No. 3, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
21	1.25	1.22	1.42	2.84	2.34	2.15	1.60	1.55	2.30	1.25	2.33	2.15
22	1.27	1.20	1.19	2.45	2.49	2.10	1.80	1.25	2.30	1.20	2.43	1.98
23	1.18	1.18	1.12	3.10	2.30	1.90	1.90	1.43	2.48	1.18	2.30	1.70
24	2.45	2.10	1.09	2.09	2.00	2.10	1.50	2.33	2.35	1.10	2.28	1.65
25	2.34	1.47	1.21	2.84	1.94	2.15	1.40	2.25	2.30	1.20	1.95	1.50
26	1.85	1.37	1.84	2.64	2.11	2.20	1.38	2.15	2.45	1.20	1.90	1.40
27	2.65	2.75	1.32	2.09	2.05	2.20	1.40	2.00	2.35	1.10	1.55	1.35
28	2.61	2.35	1.19	1.95	1.89	2.15	1.28	1.65	1.30	1.18	2.33	1.30
29	2.47	.....	1.10	1.97	2.20	1.90	1.20	3.00	2.30	1.03	2.20	1.73
30	2.10	.....	1.42	1.95	1.84	2.20	1.28	2.25	2.90	1.10	1.80	1.70
31	2.64	.....	1.95	.....	1.83	.....	1.18	2.05	.....	1.03	.....	1.55

Daily discharge, in second-feet, of Spreckels ditch at station No. 3, near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	.....	11	.....	21	14
2	.....	12	.....	22	16
3	.....	13	.....	23	16
4	.....	14	.....	24	44
5	.....	15	.....	25	[a] 44
6	.....	16	.....	26	44
7	.....	17	.....	27	34
8	.....	18	11	28	25
9	.....	19	14	29	16
10	.....	20	11	30	15
				31	[a] 23

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	32	44	24	20	25	16	32	15	22	33	9.8	19
2	29	44	18	39	27	28	31	20	34	33	9.5	16
3	20	41	16	17	24	38	27	24	23	33	9.5	16
4	33	44	14	15	25	36	36	14	25	34	9.0	15
5	42	37	12	14	27	34	32	14	18	34	9.2	14
6	30	44	12	14	29	33	33	22	16	33	9.5	24
7	27	37	11	14	32	41	32	11	34	35	14	24
8	21	46	11	12	33	34	31	10	36	34	25	14
9	18	47	11	11	33	36	30	10	31	32	12	21
10	38	62	12	11	32	36	32	10	22	27	11	20
11	16	30	11	10	26	31	37	11	42	23	10	16
12	34	25	10	9.8	26	30	34	12	33	20	9.5	16
13	36	20	9.9	9.4	25	32	31	19	25	18	33	24
14	30	24	12	8.0	33	31	30	12	24	16	34	38
15	23	22	13	7.2	33	28	40	12	33	16	30	37
16	26	20	12	8.4	30	33	31	13	25	16	18	34
17	21	18	12	26	30	30	25	31	34	20	36	34
18	19	16	12	26	35	31	22	32	34	14	32	34
19	16	16	24	42	25	32	19	35	30	14	34	34
20	13	17	14	32	38	30	22	25	34	12	32	34
21	13	13	16	48	36	31	19	18	34	13	33	31
22	13	12	12	38	39	30	23	13	34	12	38	27
23	12	12	11	56	34	25	25	16	39	12	34	21
24	38	30	11	30	27	30	18	35	36	11	34	20
25	35	17	13	48	26	31	16	33	34	12	26	18
26	24	15	24	43	30	32	15	31	38	12	25	16
27	43	46	14	30	28	32	16	27	36	11	18	15
28	42	36	12	26	25	31	14	20	14	12	35	14
29	39	.....	11	26	32	25	12	53	34	10	32	22
30	30	.....	16	26	24	32	14	33	50	11	23	21
31	43	.....	26	.....	24	.....	12	28	.....	10	.....	18

[a] Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve that is well defined below 40 second-feet.

Monthly discharge of Spreckels ditch at station No. 3, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	44	11	23.3	647	B.
1911.					
January	43	12	27.6	1,700	A.
February	62	12	29.8	1,660	B.
March	26	9.9	14.1	867	A.
April	56	7.2	23.9	1,420	A.
May	39	24	29.5	1,810	A.
June	41	16	31.3	1,860	A.
July	40	12	25.5	1,570	A.
August	53	10	21.3	1,310	A.
September	50	14	30.8	1,830	A.
October	35	10	20.1	1,240	A.
November	38	9.0	22.8	1,360	A.
December	38	14	22.8	1,400	A.
The year	62	7.2	24.9	18,000	

SPRECKELS DITCH AT STATION NO. 4, NEAR HUELO, MUAI.

Station No. 4 on Spreckels ditch was established December 18, 1910. It is about 300 feet below the trail crossing and ditch intake at Haipuaena Stream, and about 6¼ miles southeast of Kailua (Huelo post office). A staff gage, graduated into tenths of feet, is fastened to the right bank. Measurements are made from a log across the ditch about 125 feet above the gage.

The discharge at this station shows the amount of water turned into Puahakamoa Stream by Spreckels ditch. The flow of Haipuaena Stream at low and medium stages is picked up by the ditch between stations 3 and 4.

Discharge measurements of Spreckels ditch at station No. 4, near Huelo, Maui, in 1910–11.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1910.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 17	C. H. Pierce	4.9	6.3	0.92	14.3
1911.					
Jan. 21	do	5.0	6.6	1.00	16.2
Apr. 3	do	4.5	7.2	1.33	26.8
Nov. 15	J. B. Stewart	7.1	13.3	1.80	34.1

Daily gage height, in feet, of Spreckels ditch at station No. 4, near Huelo, Maui, for 1910–11.

[Tom Pahukoa and Kumagai, observers.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	1.00
2		12		22	1.10
3		13		23	1.10
4		14		24	1.90
5		15		25	1.95
6		16		26	2.00
7		17		27	1.70
8		18	0.90	28	1.40
9		19	1.00	29	1.40
10		20	.90	30	1.23
				31	

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.73	2.24	1.64	1.34	1.47	1.15	1.83	1.18	1.10	1.70	0.65	1.33
2	1.60	2.25	1.34	1.87	1.75	1.60	1.70	1.35	1.80	1.70	.65	1.20
3	1.34	1.95	1.18	1.32	1.69	1.80	1.60	1.43	1.18	1.78	.65	1.10
4	2.00	2.25	1.04	1.21	1.67	1.80	1.80	.98	1.50	1.73	.60	1.13
5	1.82	1.85	.99	1.10	1.61	1.73	1.70	1.00	1.30	1.68	.63	1.10
6	1.60	2.35	.95	1.02	1.74	1.65	1.75	.88	1.18	1.73	.93	1.50
7	1.49	1.94	.91	1.10	1.84	1.85	1.75	.83	1.83	1.88	.98	1.43
8	1.32	2.24	.87	.91	1.84	1.80	1.73	.75	1.90	1.75	1.55	1.83
9	1.20	2.00	.83	.81	2.00	1.70	1.63	.75	1.65	1.70	.90	1.40
10	2.14	2.00	.94	80	1.84	1.63	1.75	.73	1.40	1.50	.88	1.28
11	2.20	1.80	.83	.75	1.74	1.50	1.90	.80	1.93	1.45	.73	1.15
12	1.75	1.60	.75	.71	1.70	1.45	1.85	.90	1.70	1.35	.65	1.13
13	1.80	1.40	.71	.69	1.69	1.60	1.75	1.30	1.50	1.25	1.78	1.50
14	1.61	1.53	.79	.68	1.80	1.50	1.70	.93	1.50	1.18	1.85	2.10
15	1.35	1.42	.81	.65	1.85	1.45	1.90	.90	1.78	1.18	1.70	2.00
16	1.61	1.30	.79	.67	1.74	1.73	1.73	1.70	1.50	1.13	1.28	1.93
17	1.40	1.22	.74	1.75	1.72	1.60	1.60	1.70	1.70	1.35	1.90	1.83
18	1.30	1.18	.71	1.73	1.64	1.63	1.45	1.70	1.80	1.08	1.73	1.98
19	1.12	1.10	1.64	1.90	1.49	1.65	1.35	2.15	1.65	1.00	1.93	1.90
20	1.02	1.23	1.10	1.71	1.80	1.63	1.45	1.53	1.90	.93	1.90	1.80
21	1.00	1.01	1.18	1.90	1.73	1.70	1.30	1.38	1.78	.98	1.93	1.63
22	1.01	.90	.80	1.85	1.70	1.65	1.45	.95	1.90	.90	2.08	1.50
23	.93	.88	.71	2.10	1.69	1.55	1.55	1.18	1.90	.85	1.75	1.38
24	1.84	1.85	.78	1.84	1.49	1.65	1.30	1.83	1.90	.80	1.80	1.33
25	1.65	1.20	.98	2.15	1.43	1.63	1.20	1.76	1.70	.90	1.60	1.23
26	1.47	1.10	1.42	1.74	1.65	1.85	1.18	1.70	2.10	.90	1.40	1.10
27	2.24	2.00	1.12	1.71	1.47	1.70	1.20	1.58	1.90	.80	1.38	1.08
23	1.67	1.90	.83	1.70	1.40	1.70	.98	1.40	1.85	.78	1 93	1.03
29	1.49	.....	.81	1.60	1.72	1.60	.93	3.30	1.78	.73	1.78	1.40
30	1.30	.....	1.19	1.49	1.40	1.70	1.00	1.80	2.10	.80	1.50	1.33
31	2.20	.....	1.71	.....	1.25	.....	.90	1.63	.....	.70	.....	1.28

Daily discharge, in second-feet, of Spreckels ditch at station No. 4, near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	16
2		12		22	18
3		13		23	18
4		14		24	40
5		15		25	42
6		16		26	43
7		17		27	34
8		18	14	28	25
9		19	16	29	25
10		20	14	30	20
				31	a 28

a Discharge interpolated.

Daily discharge, in second-feet, of Spreckels ditch at station No. 4, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	35	50	32	23	27	19	38	20	18	34	9.0	23
2	31	50	23	39	35	31	34	23	37	34	9.0	20
3	23	41	20	22	34	37	31	26	20	36	9.0	18
4	43	50	17	20	33	37	37	16	28	35	8.5	18
5	37	38	16	18	31	35	34	16	22	33	8.8	18
6	31	53	15	16	35	32	35	14	20	35	15	28
7	28	41	14	18	38	38	35	12	38	39	16	26
8	22	50	13	14	38	37	35	11	40	35	29	38
9	20	43	12	12	43	34	32	11	32	34	14	25
10	47	43	15	12	38	32	35	10	25	28	14	22
11	49	37	12	11	35	28	40	12	41	26	10	19
12	36	31	11	10	34	26	38	14	34	23	9.0	18
13	37	25	10	9.8	34	31	35	22	28	21	37	28
14	31	29	12	9.6	37	28	34	14	28	20	38	46
15	23	25	12	9.0	38	26	40	14	36	20	34	43
16	31	22	12	9.4	35	35	35	34	28	19	21	41
17	25	20	11	35	34	31	31	34	34	23	40	38
18	22	20	10	35	32	32	26	34	37	18	35	42
19	18	18	32	40	28	32	23	47	32	16	41	40
20	16	20	18	34	37	32	26	29	40	14	40	37
21	16	16	20	40	35	34	22	25	36	16	41	32
22	16	14	12	38	34	32	26	15	40	14	45	28
23	14	14	10	46	34	29	29	20	40	13	35	25
24	38	38	12	38	28	32	22	38	40	12	37	22
25	32	20	16	47	26	32	20	36	34	14	31	20
26	27	18	25	35	32	38	20	34	46	14	25	18
27	50	43	18	34	27	34	20	31	40	12	24	18
28	33	40	12	34	25	34	16	25	38	12	41	16
29	28	.....	12	31	34	31	14	85	36	10	36	25
30	22	.....	20	28	25	34	16	37	46	12	28	23
31	49	.....	34	.....	21	.....	14	32	.....	10	.....	22

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 40 second-feet.

Monthly discharge of Spreckels ditch at station No. 4, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy
	Maximum.	Minimum.	Mean.		
1910.					
December 18–31	43	14	25.2	700	B.
1911.					
January	50	14	30.0	1,840	B.
February	53	14	32.5	1,800	B.
March	34	10	16.3	1,000	B.
April	47	9.0	25.6	1,520	B.
May	43	21	32.8	2,020	B.
June	38	19	32.1	1,910	B.
July	40	14	28.8	1,770	B.
August	85	10	25.5	1,570	B.
September	46	18	33.8	2,010	B.
October	39	10	22.0	1,350	B.
November	45	8.5	26.0	1,550	B.
December	46	16	27.0	1,660	B.
The year	85	8.5	27.6	20,000	

SPRECKELS DITCH AT STATION NO. 5, NEAR HUELO, MAUI.

Station No. 5 on Spreckels ditch is about 150 feet above the ditchman's house at Alo division weir and about 5 miles by trail southeast of Kailua (Huelo post office). The station was established November 6, 1911.

A staff gage, graduated into tenths of a foot, is fastened to the left bank and is used to obtain gage heights. Measurements are made from a log across the ditch at the gage.

The discharge at this station shows the amount of water turned into Alo Stream below the station on the stream. Between this station and station No. 4 the ditch receives the combined flow of Puahakamoa and several other smaller streams at low and medium stages.

Discharge measurements of Spreckels ditch at station No. 5, near Huelo, Maui, for 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 10	J. B. Stewart	7.4	10.2	0.98	16.2
14	do	7.8	17.7	2.06	41.9
14	do	7.3	10.4	1.07	19.4
20	do	8.0	20.2	2.38	52.5
Dec. 5	do	7.4	13.1	1.40	26.8

Daily gage height, in feet, of Spreckels ditch at station No. 5, near Huelo, Maui, for 1911.

[Tokunaga, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	1.95	11	0.90	1.63	21	2.50	2.24
2	.....	1.74	12	.76	1.49	22	2.43	2.22
3	.....	1.55	13	2.44	2.20	23	2.36	2.00
4	.....	1.68	14	2.56	2.42	24	2.38	2.21
5	.....	1.40	15	2.38	2.39	25	2.30	1.75
6	1.05	2.24	16	1.88	2.19	26	2.10	1.58
7	1.12	2.00	17	2.54	2.36	27	1.88	1.48
8	2.27	2.45	18	2.40	2.42	28	2.46	1.48
9	1.20	2.04	19	2.54	2.40	29	2.34	2.10
10	.94	1.90	20	2.38	2.30	30	2.22	1.80
						31	.....	1.94

Daily discharge, in second-feet, of Spreckels ditch at station No. 5, near Huelo, Maui, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	40	11	16	31	21	56	48
2	.....	34	12	13	28	22	54	47
3	.....	29	13	54	47	23	52	41
4	.....	32	14	58	53	24	53	47
5	.....	26	15	53	53	25	50	34
6	19	48	16	38	47	26	44	30
7	20	41	17	58	52	27	38	28
8	48	54	18	53	53	28	54	28
9	22	42	19	58	53	29	52	44
10	17	38	20	53	50	30	48	35
						31	.....	40

NOTE.—Daily discharge computed from a rating curve that is well defined.

Monthly discharge of Spreckels ditch at station No. 5, near Huelo, Maui, for Nov. 6 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 6–30	58	13	43.2	2,140	A.
December	54	28	41.1	2,530	A.

SPRECKELS DITCH AT STATION NO. 6, NEAR HUELO, MAUI.

Station No. 6 on Spreckels ditch is about 115 feet below the intake of Kolea Stream west of Waikamoi, and about 4 miles by trail from Kailua (Huelo post office).

A staff gage, graduated into tenths of a foot, is fastened to the left bank and is used to obtain gage heights. Measurements are made from a log across the ditch about 10 feet above the gage.

Between this station and Station No. 5, Spreckels ditch receives the combined flow of Alo, Waikamoi, and Kolea streams at low and medium stages, and also one-third of the water of Koolau ditch, which enters the Spreckels ditch below the Alo division weir.

Discharge measurements of Spreckels ditch at station No. 6, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 2	J. B. Stewart	6.9	8.8	1.00	26.8
10	do	6.6	10.4	1.26	38.5
11	do	6.5	9.8	1.20	37.5
Dec. 7	do	6.7	5.9	0.60	16.4
7	do	7.0	11.3	1.41	44.6

Daily gage height, in feet, of Spreckels ditch at station No. 6, near Huelo, Maui, for 1911.

[Tokunaga, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	1.21	11	1.15	1.42	21	1.68	1.47
2	.....	1.58	12	1.02	1.42	22	1.68	1.47
3	.....	1.57	13	1.45	1.43	23	1.57	1.47
4	.....	1.37	14	1.58	1.45	24	1.59	1.51
5	.....	1.30	15	1.65	1.40	25	1.60	1.48
6	1.26	1.41	16	1.67	1.49	26	1.59	1.47
7	1.50	1.40	17	1.62	1.48	27	1.59	1.47
8	1.62	1.39	18	1.65	1.48	28	1.49	1.46
9	1.42	1.38	19	1.65	1.48	29	1.26	1.47
10	1.22	1.35	20	1.65	1.48	30	1.26	1.48
						31	.....	1.47

Daily discharge, in second-feet, of Spreckels ditch at station No. 6, near Huelo, Maui, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		35	11	33	45	21	60	48
2		54	12	29	45	22	60	48
3		53	13	46	46	23	53	48
4		42	14	54	46	24	54	50
5		39	15	58	44	25	55	48
6	37	44	16	59	48	26	54	48
7	49	44	17	56	48	27	54	48
8	56	44	18	58	48	28	48	47
9	45	43	19	58	48	29	37	48
10	36	42	20	58	48	30	37	48
						31		48

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 50 second-feet.

Monthly discharge of Spreckels ditch at station No. 6, near Huelo, Maui, for Nov. 6 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 6–30	60	29	49.8	2,470	B.
December	54	35	46.3	2,850	A.

SPRECKELS DITCH AT STATION NO. 7, NEAR HUELO, MAUI.

Station No. 7 on Spreckels ditch is located about 40 feet below the lower portal of the first tunnel west of Oopuola Stream and about $1\frac{3}{4}$ miles east of Kailua (Huelo post office). It was established November 6, 1911.

A staff gage, graduated into tenths of a foot, is fastened to the left bank and is used to obtain gage heights. Measurements are made from a log across the ditch 12 feet below the gage.

Between this station and station No. 6 Spreckels ditch receives the combined flow of Pohakuhame, Punaluu, Kaaiea, Makanale, and Oopuola streams at low and medium stages. Water may be turned out of the ditch at Oopuola Stream when so desired and picked up again by Center ditch at a lower elevation.

Discharge measurements of Spreckels ditch at station No. 7, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 9	J. B. Stewart	7.0	10.9	1.65	46.1
11	....do	6.8	9.8	1.47	40.7
13	....do	7.1	11.6	1.82	54.7
Dec. 5	....do	6.8	5.8	0.95	20.1
7	....do	6.8	9.7	1.00	20.4
13	....do	6.9	9.7	1.00	22.0

Daily gage height, in feet, of Spreckels ditch at station No. 7, near Huelo, Maui, for 1911.

[John Pacheco, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11	1.4	0.95	21	2.0	1.2
2			12	1.3	.9	22	1.95	1.2
3			13	2.0	1.0	23	1.9	1.15
4		1.0	14	1.9	1.15	24	1.95	
5		1.0	15	1.95	1.0	25	1.8	
6	1.2	1.2	16	1.8	1.1	26	1.8	1.1
7		1.0	17	2.2		27	1.7	1.1
8	1.8	1.35	18	1.95	1.2	28		1.1
9	1.65	1.0	19		1.2	29		1.15
10	1.5		20	1.85	1.2	30		1.1
						31		

Daily discharge, in second-feet, of Spreckels ditch at station No. 7, near Huelo, Maui, for 1911.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		a 30	11	36	19	21	65	28
2		a 25	12	32	18	22	62	28
3		a 23	13	65	21	23	60	26
4		21	14	60	26	24	62	a 26
5		21	15	62	21	25	55	a 24
6	28	28	16	55	24	26	55	24
7	a 42	21	17	75	a 26	27	50	24
8	55	34	18	62	28	28	a 50	24
9	48	21	19	a 60	28	29	a 45	26
10	40	a 20	20	58	28	30	a 40	24
						31		a 24

a Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve that is well defined below 60 second-feet.

Monthly discharge of Spreckels ditch at station No. 7, near Huelo, Maui, for Nov. 6 to Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 6–30	75	28	52.9	2,620	B.
December	34	18	24.5	1,510	B.

NOTE.—Water was wasted at Oopuola spillway during December.

SPRECKELS DITCH AT STATION NO. 8, NEAR HUELO, MAUI.

Station No. 8 on Spreckels ditch was established November 8, 1911, about 275 feet above the weir outlet into the Papaaea reservoir 1 mile east of Kailua (Huelo post office).

A staff gage, graduated in tenths of a foot, is fastened to the right bank and is used for obtaining gage heights. Measurements are made from a plank across the ditch at the gage.

During the latter part of 1911 water was turned out of Spreckels ditch above this station and picked up by Center ditch below.

Discharge measurements of Spreckels ditch at station No. 8, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Nov. 7	J. B. Stewart	6.5	14.4	2.09	45.8
9	do	6.4	14.4	2.11	45.2
13	do	6.5	17.0	2.41	58

Daily gage height, in feet, of Spreckels ditch at station No. 8, near Huelo, Maui, for 1911.

Day.	Nov.	Day.	Nov.	Day.	Nov.
1		11	2.02	21	2.55
2		12		22	2.52
3		13	2.45	23	2.40
4	1.61	14	2.70	24	2.50
5		15	2.50	25	2.30
6		16	2.32	26	
7	2.10	17	2.75	27	2.20
8	2.30	18	2.50	28	
9	2.10	19		29	
10	1.95	20	2.35	30	
				31	

Daily discharge, in second-feet, of Spreckels ditch at station No. 8, near Huelo, Maui, for 1911.

Day.	Nov.	Day.	Nov.	Day.	Nov.
1		11	42	21	65
2		12	*a* 51	22	63
3		13	60	23	58
4	32	14	74	24	63
5	*a* 36	15	63	25	53
6	*a* 40	16	53	26	*a* 51
7	45	17	77	27	49
8	53	18	63	28	
9	45	19	*a* 59	29	
10	40	20	55	30	
				31	

a Discharge interpolated.

NOTE.—Daily discharge computed from a rating curve that is poorly defined.
Owing to a break in the ditch no water was carried past this station from Nov. 28 to Dec. 31, 1911.

CENTER DITCH REGION.

CENTER DITCH NEAR HUELO, MAUI.

Center ditch region includes that part of the ditch country of East Maui below Spreckels ditch east of Nailiilihaele Stream and west of Honomanu.

Center ditch is an extension of Lowrie ditch east of Nailiilihaele Stream. It takes up water from the streams which originate below or pass Spreckels ditch.

A staff gage, graduated in inches, is used by the Hawaiian Commercial & Sugar Co. to obtain the daily stage of the ditch. This gage is located near the ditchman's house, about 3 miles by trail from Kailua (Huelo post office). It is between Kolea and Punaluu streams.

Current meter measurements are made from a plank across the ditch at the gage.

The gage-height records for 1910–11 were furnished by the Hawaiian Commercial & Sugar Co.

Discharge measurements of Center ditch near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Inches.*	*Sec.-ft.*
Nov. 16	J. B. Stewart	8.4	18.5	26⅜	54.5
Dec. 5	do	7.5	10.9	18½	25.3
7	do	8.9	18.7	29¼	48.0
8	do	12.0	41.6	55½	96.6
13	do	9.4	24.7	37½	66.1

NOTE.—An additional measurement made early in 1912 was used in determining the rating.

Daily gage height, in inches, of Center ditch near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	19½	49	6	42½	26½	43½	17½	14½	21	41½	4	57½
2	13	48½	9	40⅜	49½	45¼	17½	10½	14½	51¼	4	48½
3	9	47	42½	40¾	44½	43½	23	46½	25	53	4	39
4	26¾	45½	49¾	42¾	49	44¾	47	55	20	48¾	27	49
5	41½	44½	36	42	47	44¼	44¾	49	19	32½	4	41
6	37¾	40¾	36	41¾	46¼	43½	39¾	45½	13	43	4	41¼
7	35¼	34½	41	47	48¾	45	42¾	42	9	38½	4½	9½
8	27½	28	31½	49	44½	45	35½	38½	9¾	35½	4	12½
9	16½	23½	23	44½	45½	44¾	29½	41½	5½	47¼	4	15
10	20½	20	18	41½	43¼	44½	24¾	35¼	4¾	50½	4¼	11
11	39	17½	17	39	43	48½	32½	29½	4½	38¼	4	10½
12	46½	36½	11	32¾	39¼	48	34½	38	4½	28	4	5¼
13	41¾	44	7½	27	35	51½	21	47¾	4½	23½	3½	0
14	41½	32	8	25½	28½	49	29¾	48½	4	15½	3¼	7¼
15	42	24	6	22¼	33½	54	50¼	42½	4	10¼	3	13¾
16	42	19	5	17½	46½	50	49½	33¾	5	12	3½	12¾
17	43½	15¼	4¾	36¼	39½	47	44¾	26¼	4	13½	30¼	10½
18	44½	17½	5	48½	42	48	41½	25¾	4	6	43½	8½
19	44	21¼	21	41	45½	46½	39	23	4	5	41	11½
20	42	8¾	42	36	42½	48	34	51	4	5½	18¾	5½
21	47¼	28	43½	35½	37	49¾	28	45½	4	25½	10	5½
22	45½	47½	42½	27½	30½	47	24½	40¼	4	28½	5½	16½
23	45	40½	47	28½	31¾	43	23	42½	4¼	44½	22½	6
24	45½	30½	44	42	36½	33½	19	44¾	5	21½	48	55
25	43¼	22½	42½	43½	28	35½	32	51	4	8½	22	31
26	41	16½	42½	50	25¼	25¾	21½	43	4	4¾	9	32½
27	48	15	42¼	42	18¾	29	20	41½	4	4	5½	37½
28	26½	13	40	35½	15½	22½	15	47	15½	8¼	27½	40
29	44	.....	37½	28	12¼	25	11	36	6¼	12½	58½	28
30	48	.....	32½	19½	10	20¼	13	27¼	52¾	4¾	54	21½
31	49½	.....	44½	.....	54	.....	23½	22	.....	4	.....	32¼
1911.												
1	41¾	47	37	29½	43	18½	38½	12½	33	47¼	4	32½
2	39½	53	28	29¾	53	38	40½	26¼	39	48	3¾	25
3	26¼	51	20½	29	41½	43¾	36¾	18	32	52	3¾	18¾
4	52	52	15½	16¾	26¾	47	45	9½	30	51	3½	21½
5	51½	50¼	12	9½	29½	50	42¼	10¾	25½	50¾	3½	19½
6	29½	43	8¾	6½	48	45½	43½	4½	17½	38½	5	47½
7	28	42½	6¾	5¾	41½	48½	44	4¾	43	50½	5½	37½
8	25	46½	6	5½	33	47½	42½	4¾	52¾	48½	33¼	55½
9	20½	45	13	5	52	48	40	6¼	49	50¾	10	44
10	56	44½	9¼	8	47¾	51¼	42½	6½	34½	51	5	34
11	52	34½	5½	8	44	45¾	46	8¾	54	46¾	5½	29½
12	53¾	42	5	7½	44	43½	46	8¾	52½	39	4¾	21
13	53	41	4¾	7	42½	46¼	43¼	25¼	40	33½	29	42½
14	46½	36	5½	5¼	53½	45½	40¾	5	37½	33½	52¼	54½
15	42	29½	16	3½	52½	41¾	44¾	4	44	30½	52½	56

Daily gage height, in inches, of Center ditch near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
16	30	14½	9¼	3	48¼	45	44½	46½	39	26¼	26½	56½
17	28	13	3½	43½	46	40½	36	43¼	40½	37	50½	54½
18	22¼	13¾	3	39¼	47¼	39	28¾	28½	43	25	49½	55
19	13	10¾	23	36	42	44½	24½	54	43¾	21½	47¾	55
20	11¾	16	21½	40¼	40½	42¼	36	44	52	19½	48¼	54
21	9½	11¼	4	36½	41¾	48½	23	25½	50½	19½	50½	52¾
22	11	13½	12	33½	41	44½	25½	21	53½	17¼	50¼	48½
23	9	7¾	3¼	40	47	34¼	36	15½	53½	5¾	50½	32¾
24	47½	18	3	49¾	40¾	31¼	22	48½	51¼	5	49½	46
25	47	17	3	46½	33½	35½	17¾	52¾	48½	5½	43	29¼
26	36	10¼	2¾	47¼	33½	40½	15	50¾	51¾	10	31½	23
27	52½	35	11¾	45¼	34½	42	17¾	36¾	49	4¾	28½	20½
28	50½	44½	8½	51	33¼	41½	11	28	50¼	4½	55¼	19
29	39½	.....	2¼	42¼	39¾	34¼	9½	48	47½	4¼	52½	41½
30	33¾	.....	2¼	35¾	30¼	33¼	6½	53½	56¼	4	45	26¾
31	46½	.....	34¼	.....	27	.....	6½	47½	.....	4	.....	32

Daily discharge, in second-feet, of Center ditch near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	28	90	4.9	78	42	81	24	18	31	77	2.9	98
2	15	90	8.5	76	90	84	24	10	18	92	2.9	90
3	8.5	87	79	76	83	81	35	86	40	94	2.9	71
4	44	85	91	80	90	84	87	96	29	90	44	90
5	77	83	65	78	87	82	84	90	47	56	2.9	76
6	68	76	65	78	86	81	73	85	15	80	2.9	76
7	64	62	76	87	90	84	80	78	8.5	70	3.4	9.2
8	45	46	54	90	83	84	64	70	9.7	64	2.9	14
9	22	36	35	83	85	84	50	77	4.4	88	2.9	19
10	30	29	25	77	80	83	39	64	3.6	92	3.2	11
11	71	24	23	71	80	90	56	50	3.4	70	2.9	10
12	86	66	11	57	72	89	62	69	3.4	46	2.9	4.2
13	78	82	6.6	44	63	92	31	88	3.4	36	2.4	0.0
14	77	55	7.2	41	47	90	50	90	2.9	20	2.2	6.3
15	78	37	4.9	34	59	95	91	79	2.9	10	2.0	16
16	78	27	3.9	24	86	91	90	60	3.9	13	2.4	14
17	81	20	3.6	66	72	87	82	42	2.9	16	52	10
18	83	24	3.9	90	78	89	77	40	2.9	4.9	81	7.8
19	82	32	31	76	85	86	71	35	2.9	3.9	76	12
20	78	8.2	78	65	79	89	60	92	2.9	4.4	26	4.4
21	88	46	80	64	67	91	46	85	2.9	41	10	4.4
22	85	88	79	45	52	87	38	74	2.9	47	4.4	22
23	84	75	87	47	54	80	35	79	3.2	83	34	4.9
24	85	52	82	78	66	59	27	84	3.9	32	89	96
25	80	34	79	81	46	64	55	92	2.9	7.8	33	53
26	76	22	79	91	40	42	32	80	2.9	3.6	8.5	56
27	89	19	78	78	26	48	29	77	2.9	2.9	4.4	68
28	86	15	74	64	20	34	19	87	20	7.5	45	74
29	82	.....	68	46	14	40	11	65	5.2	14	98	46
30	89	.....	56	28	10	30	15	44	94	3.6	95	32
31	90	.....	83	.....	95	.....	36	33	.....	2.9	.....	56
1911.												
1	78	87	67	50	80	26	70	14	58	88	2.9	56
2	72	94	46	50	94	69	74	42	71	89	2.7	40
3	42	92	30	48	77	82	66	25	55	93	2.7	26
4	93	93	20	22	44	87	84	9.2	51	92	2.4	32
5	92	91	13	9.2	50	91	78	11	41	92	2.4	28
6	50	80	8.2	5.4	89	85	81	3.4	24	70	3.9	88
7	46	79	5.8	4.6	76	90	82	3.6	80	92	4.4	68
8	40	86	4.9	4.4	58	88	79	3.6	94	90	58	96
9	30	84	15	3.9	93	89	74	5.4	90	92	10	82
10	97	83	8.9	7.2	88	92	79	5.4	62	92	8.9	60

Daily discharge, in second-feet, of Center ditch near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
11	93	62	4.4	7.2	82	86	86	8.2	95	87	4.2	50
12	95	78	3.9	6.6	82	81	86	8.2	94	71	3.6	31
13	94	76	3.6	6.0	79	86	80	40	74	59	48	79
14	86	65	4.4	4.2	95	85	76	3.9	68	59	93	96
15	78	50	21	2.4	94	78	84	2.9	82	52	94	97
16	51	18	8.9	2.0	89	84	83	86	71	42	43	97
17	46	15	2.4	81	86	75	65	80	75	67	92	96
18	34	16	2.0	72	88	71	48	47	80	40	90	96
19	15	11	35	65	78	83	38	95	82	32	88	96
20	12	21	32	74	75	78	65	82	93	28	89	95
21	9.2	12	2.9	66	78	90	35	41	92	28	92	94
22	11	16	13	59	76	83	41	31	94	24	91	89
23	8.5	6.9	2.2	74	87	61	65	20	94	4.6	91	57
24	88	25	2.0	91	76	54	33	89	92	3.9	90	86
25	87	23	2.0	86	59	64	24	94	90	4.4	80	49
26	65	10	1.8	88	59	75	19	92	93	10	54	35
27	94	63	12	84	62	78	24	66	90	3.6	47	30
28	92	83	7.8	92	58	77	11	46	91	3.4	96	27
29	72	.....	1.4	78	73	61	9.2	89	88	3.2	94	77
30	60	.....	1.4	64	52	58	5.4	94	97	2.9	84	44
31	86	.....	61	.....	44	.....	5.4	88	.....	2.9	.....	55

NOTE.—Daily discharge computed from a rating curve that is well defined above 20 second-feet.

Monthly discharge of Center ditch near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
January	90	8.5	68.6	4,220	A.
February	90	8.2	50.4	2,800	A.
March	91	3.6	49.1	3,020	B.
April	91	24	66.4	3,950	A.
May	95	10	65.4	4,020	A.
June	95	30	76.7	4,560	A.
July	91	11	50.7	3,120	A.
August	96	10	68.4	4,210	A.
September	94	2.9	11.9	708	C.
October	94	2.9	41.0	2,520	B.
November	98	2.0	24.7	1,470	C.
December	98	4.2	37.1	2,280	B.
The year	98	2.0	50.9	36,900	
1911.					
January	97	8.5	61.8	3,800	A.
February	94	6.9	54.3	3,020	A.
March	67	1.4	14.3	879	C.
April	92	2.0	43.6	2,590	C.
May	95	44	74.9	4,610	A.
June	92	26	76.9	4,580	A.
July	86	5.4	56.5	3,470	A.
August	95	2.9	42.8	2,630	C.
September	97	24	78.7	4,680	A.
October	93	2.9	49.0	3,010	B.
November	96	2.4	51.9	3,090	C.
December	97	26	66.1	4,060	A.
The year	97	1.4	55.8	40,400	

HAMAKUA DITCH REGION.

GENERAL FEATURES.

The Hamakua ditch region includes that part of the ditch country of East Maui west of Nailiilihaele Stream. Five ditches at different levels are used to convey the water from this region to the cane fields on the isthmus of Maui. In order of elevation they are Haiku, Lowrie, Old Hamakua, New Hamakua, and Kailuanui ditches. They cross about 20 gulches east of Maliko, all of which have more or less water at all times and large quantities after storms.

The Hamakua ditch proper begins at Nailiilihaele Stream. From the Alo division weir to the Nailiilihaele two-thirds of the water from the Koolau ditch is carried by the Hamakua ditch extension. No water is taken into this ditch between these two points. The old Hamakua ditch, built by H. P. Baldwin and Sam Alexander in 1876–78, started from the main branch of the Nailiilihaele at a much higher elevation than the present intake of the new Hamakua ditch. It was of irregular grade, dropping into gulches and taking out again farther down, finally delivering the water to the lands of the Haiku Sugar Co. and the Paia plantation at an elevation of 850 feet. The total length of the ditch was 34 miles and its capacity 40 second-feet.

The new Hamakua ditch, starting at an elevation of 1,190 feet, has a regular grade of 5 feet to the mile and a length of 16 miles. Its maximum capacity is 120 second-feet. The two ditches cross in Hoolawanui Stream, just east of Lupi.

All of the measurements made in this region have been made near the trails which follow these two ditches.

NAILIILIHAELE STREAM NEAR HUELO, MAUI.

Nailiilihaele is one of the largest of the streams supplying water to the East Maui ditches. It rises far up on the northern slope of Haleakala, where the rainfall is heavy. The total flow of the stream at low stages is taken by the new Hamakua ditch; at higher stages water passes down the stream to the Lowrie and Haiku ditches below.

The gaging station was established on Nailiilihaele Stream just above the crossing of new Hamakua ditch, about 1½ miles south of Kailua (Huelo post office), December 9, 1910. A staff gage, graduated in tenths of feet and consisting of two parts, is fastened to the right bank about 12 feet above the ditch. Only wading measurements have been made. The discharge at this point gives the total flow of the stream above all diversions.

A large tributary from the west joins the main Nailiilihaele Stream about half a mile above the gaging station.

Discharge measurements of Nailiilihaele Stream near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 18	Pierce and Schulz	27.4	32.4	2.25	20.6

NOTE.—Additional measurements made early in 1912 were used in determining the rating. Measurements made by wading at various sections.

Daily gage height, in feet, of Nailiilihaele Stream near Huelo, Maui, for 1910–11.

[Weymura, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	1.86
2		12	2.35	22	1.97
3		13	2.30	23	1.94
4		14	2.22	24	4.26
5		15	2.20	25	3.01
6		16	2.10	26	5.55
7		17	2.01	27	3.26
8		18	1.92	28	2.90
9	2.75	19	1.96	29	2.42
10		20	1.91	30	2.38
				31	3.10

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1911.												
1	3.45	2.80	2.65	2.30	2.40	2.20	2.90	1.80	2.42	3.05	1.55	2.32
2	2.85	3.90	2.45	2.35	2.65	2.45	2.65	2.08	2.58	2.80	1.52	2.25
3	2.65	3.35	2.20	2.25	2.50	2.75	2.55	1.82	2.32	2.80	1.50	2.18
4	3.35	4.30	2.00	2.10	2.35	3.25	2.65	1.75	2.30	2.90	1.50	2.20
5	3.25	3.15	1.98	2.05	2.25	2.35	2.55	1.68	2.25	2.80	1.50	2.10
6	2.75	4.45	1.86	1.95	2.60	3.05	2.65	1.58	2.18	2.75	1.65	2.75
7	2.70	3.15	1.80	1.88	2.65	3.30	2.60	1.60	2.70	2.85	1.75	2.45
8	2.54	4.35	1.75	1.80	2.50	3.45	2.65	1.60	3.00	2.90	2.35	2.95
9	2.50	4.50	1.71	1.74	3.55	3.55	2.65	1.65	2.70	2.75	1.75	2.35
10	2.60	6.25	1.90	1.70	3.45	3.55	2.75	1.58	2.45	2.60	1.62	2.32
11	2.90	3.05	1.68	1.70	2.70	3.05	3.05	1.60	3.65	2.60	1.62	2.22
12	2.95	2.75	1.62	1.68	2.55	2.75	3.10	1.65	2.85	2.45	1.60	2.18
13	3.20	2.60	1.60	1.60	2.50	3.05	2.55	2.25	2.55	2.28	2.50	2.28
14	2.55	2.50	1.89	1.60	2.85	2.85	2.50	1.68	2.40	2.20	2.90	2.90
15	2.60	2.35	2.15	1.55	3.05	2.65	2.90	1.60	2.55	2.18	2.85	3.15
16	2.35	2.30	1.95	1.52	3.30	2.75	2.65	2.70	2.38	2.12	2.28	2.92
17	2.30	2.22	1.84	3.10	3.05	2.65	2.50	2.55	2.65	2.30	3.20	2.85
18	2.25	2.15	1.75	2.40	2.90	2.65	2.35	2.45	3.25	2.05	2.75	3.00
19	2.18	2.05	2.36	2.30	2.55	2.65	2.30	3.50	2.58	1.92	2.82	2.92
20	2.08	2.10	2.20	2.70	2.55	2.70	2.35	2.45	3.65	1.88	3.00	2.82
21	2.05	2.00	1.82	3.25	3.30	2.65	2.30	2.25	3.05	1.82	3.05	2.70
22	2.00	1.95	2.00	3.20	3.00	2.70	2.25	2.20	3.45	1.82	3.20	2.58
23	1.95	1.84	1.86	4.25	2.65	2.55	2.30	2.10	3.00	1.78	3.05	2.45
24	2.70	1.95	1.90	3.45	2.55	2.55	2.20	2.75	3.05	1.70	2.90	2.40
25	2.45	1.92	1.82	3.55	2.40	2.60	2.15	2.90	2.80	1.70	2.50	2.28
26	2.35	1.82	1.92	3.45	2.50	2.85	2.10	2.75	3.30	1.75	2.35	2.20
27	2.80	3.00	1.80	2.60	2.45	2.55	2.05	2.45	3.00	1.68	2.30	2.12
28	3.80	3.75	1.71	2.50	2.35	2.60	1.95	2.32	3.15	1.62	3.55	2.15
29	2.60	.....	1.70	2.50	2.65	2.45	1.88	3.30	2.85	1.60	2.80	2.25
30	2.40	.....	2.04	2.50	2.40	2.45	1.80	3.35	4.50	1.60	2.50	2.20
31	2.85	.....	2.60	.....	2.25	.....	1.78	2.60	.....	1.58	.....	2.25

Daily discharge, in second-feet, of Nailiilihaele Stream near Huelo, Maui, for 1910–11.

Day.	Dec	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11	a 28	21	12
2		12	24	22	14
3		13	22	23	14
4		14	19	24	128
5		15	19	25	48
6		16	17	26	240
7		17	15	27	61
8		18	13	28	43
9	37	19	14	29	25
10	a 32	20	13	30	25
				31	53

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	73	39	33	22	25	19	43	11	25	50	7.2	22
2	41	100	26	24	33	26	33	17	31	39	6.6	20
3	33	67	19	20	28	37	30	11	22	39	6.6	19
4	67	130	15	17	24	61	33	10	22	43	6.6	19
5	61	56	15	16	20	24	30	9.2	20	39	6.6	17
6	37	145	12	14	31	50	33	7.8	19	37	8.5	37
7	35	56	11	13	33	64	31	7.8	35	41	10	26
8	30	135	10	11	28	73	33	7.8	48	43	24	46
9	28	150	9.2	10	79	79	33	8.5	35	37	10	24
10	31	300	13	9.2	73	79	37	7.8	26	31	7.8	22
11	43	50	9.2	9.2	35	50	50	7.8	85	31	7.8	19
12	46	37	7.8	9.2	30	37	53	8.5	41	26	7.8	19
13	58	31	7.8	7.8	28	50	30	20	30	22	28	22
14	30	28	13	7.8	41	41	28	9.2	25	19	43	43
15	31	24	18	7.2	50	33	43	7.8	30	19	41	56
16	24	22	14	6.6	64	37	33	35	25	17	22	43
17	22	19	12	53	50	33	28	30	33	22	58	41
18	20	18	10	25	43	33	24	26	61	16	37	48
19	20	16	24	22	30	33	22	76	31	13	39	43
20	17	17	19	35	30	35	24	26	85	13	48	39
21	16	15	11	61	64	33	22	20	50	11	50	35
22	15	14	15	58	48	35	20	19	73	11	58	31
23	14	12	12	130	33	30	22	17	48	11	50	26
24	35	14	13	73	30	30	19	37	50	9.2	43	25
25	26	13	11	79	25	31	18	43	39	9.2	28	22
26	24	11	13	73	28	41	17	37	64	10	24	19
27	39	48	11	31	26	30	16	26	48	9.2	22	17
28	95	92	9.2	28	24	31	14	22	56	7.8	79	18
29	31	.....	9.2	28	33	26	13	64	41	7.8	39	20
30	25	.....	16	28	25	26	11	67	150	7.8	28	19
31	41	.....	31	.....	20	.....	11	31	.....	7.8	.....	20

a Discharge interpolated.

NOTE.—Daily discharge computed from a poorly defined rating curve. Discharge applied to nearest half tenth of gage height.

Monthly discharge of Nailiilihaele Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 9-31	12	240	39.8	1,820	D.
1911.					
January	95	14	35.7	2,200	D.
February	300	11	59.2	3,290	D.
March	33	7.8	14.5	892	D.
April	130	6.6	30.9	1,840	D.
May	79	20	36.5	2,240	D.
June	79	19	40.2	2,390	D.
July	53	11	27.5	1,690	D.
August	76	7.8	23.5	1,440	D.
September	150	19	44.9	2,670	D.
October	50	7.8	22.5	1,380	D.
November	79	6.6	28.2	1,680	D.
December	56	17	28.3	1,740	D.
The year	300	6.6	32.4	23,500	

KAILUA STREAM NEAR HUELO, MAUI.

Kailua Stream, which is just west of Nailiilihaele Stream, is one of the large streams supplying the East Maui ditches. Its principal tributary is Oanui Stream, which enters it from the west just below new Hamakua ditch. The total flow of Kailua Stream at low stages is taken by the new Hamakua ditch; at higher stages water passes down to the Lowrie and Haiku ditches below.

A gaging station was established on this stream about 400 feet above the flume crossing the new Hamakua ditch and about 1 mile above Kailua (Huelo post office) December 8, 1910.

A staff gage, graduated into tenths of a foot, is fastened to stones on the left bank. The channel is exceedingly rough near the gage, but smooths out several hundred feet farther upstream, giving a good measuring section. A wire footbridge was built at this place and several measurements made in January, 1911.

The gage heights are affected by the gate openings of the feeder ditch. For this reason it has been necessary to make separate ratings for use according as the intake gate is open or closed. As insufficient measurements were obtained for rating the stream with the intake gate open, estimates have been made only in the case of the gate closed, which give the total flow of the stream above all diversions.

No measurements have been obtained at this station since January, 1911.

Discharge measurements of Kailua Stream near Huelo, Maui, 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 7[a]	Pierce and Schulz	47.5	17	2.78	9.6
10	.....do	29	84	3.80	119
11	.....do	25	62	3.10	31.6
25	Pierce and Martin	22	52	2.70	18.3

[a] Measurement made by wading on crest of concrete dam at Old Hamakua ditch intake. No water diverted.

NOTE.—Measurements made from bridge several hundred feet above gage, except as noted. New Hamakua ditch intake closed during the measurements.

Daily gage height, in feet, of Kailua Stream near Huelo, Maui, for 1910–11.

[Weymura, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11	2.40	21	1.41
2		12	1.80	22	1.55
3		13	1.68	23	1.42
4		14	1.60	24	3.98
5		15	1.52	25	3.26
6		16	1.50	26	4.65
7		17	1.46	27	3.02
8	4.00	18	1.44	28	2.41
9	3.72	19	1.46	29	1.75
10	3.55	20	1.40	30	1.64
				31	3.10

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	3.35	3.00	2.90	1.98	2.40	1.72	2.95	1.22	2.08	3.50	1.10	1.70
2	2.75	4.50	2.60	2.30	2.55	1.98	3.00	1.32	2.40	3.15	1.05	1.68
3	2.15	3.80	1.65	2.20	2.25	2.20	2.75	1.22	1.72	3.00	1.05	1.48
4	4.20	4.10	1.52	1.75	1.95	4.05	2.90	1.15	1.62	3.30	1.00	1.48
5	4.25	3.25	1.48	1.55	1.72	3.40	2.85	1.10	1.65	3.20	1.02	1.42
6	2.80	4.75	1.42	1.46	2.50	3.45	2.90	1.50	1.60	3.20	1.12	2.10
7	2.85	3.25	1.40	1.38	2.35	3.40	2.75	1.30	2.85	3.70	1.12	1.55
8	2.52	5.50	1.40	1.30	1.95	3.70	2.95	1.30	3.70	3.40	1.80	3.40
9	2.45	6.05	1.34	1.30	3.65	3.65	3.00	1.10	2.75	3.00	1.18	1.75
10	3.80	7.00	1.42	1.29	3.35	3.75	3.15	1.30	2.22	2.75	1.08	1.60
11	3.00	3.15	1.34	1.22	2.80	3.50	3.25	1.30	3.95	2.68	1.10	1.52
12	3.10	3.05	1.32	1.20	2.35	3.10	3.25	1.30	3.20	2.58	1.05	1.50
13	3.45	2.95	1.30	1.20	2.25	3.15	2.85	1.45	2.50	2.35	1.78	1.62
14	2.75	2.70	1.59	1.15	2.90	3.05	2.85	1.12	2.05	1.55	3.20	3.90
15	2.60	2.45	1.85	1.12	3.45	3.85	2.90	1.30	2.40	1.58	3.05	4.60
16	1.82	1.90	1.62	1.10	3.40	2.90	2.85	2.90	2.10	1.52	1.75	3.85
17	1.88	1.82	1.44	3.30	3.15	2.75	2.50	2.60	2.90	1.58	3.80	3.50
18	1.72	1.68	1.40	2.35	3.20	2.65	1.68	1.52	3.55	1.48	2.80	3.90
19	1.60	1.55	2.25	1.95	2.65	2.95	1.65	4.00	2.65	1.38	2.80	3.75
20	1.58	1.58	1.90	2.00	2.60	2.85	1.62	2.55	4.25	1.30	3.50	3.20
21	1.50	1.52	1.44	3.10	3.25	2.75	1.60	1.55	3.05	1.32	3.85	2.75
22	1.50	1.48	1.44	2.55	2.95	2.80	1.62	1.45	3.65	1.28	3.95	2.50
23	1.45	1.45	1.40	4.80	3.05	2.65	1.68	1.42	3.30	1.22	3.90	2.32
24	2.50	1.48	1.42	4.55	2.55	1.88	1.60	2.70	3.60	1.18	2.85	2.45
25	2.75	1.50	1.41	4.55	2.42	1.98	1.50	3.15	3.05	1.15	2.00	1.75
26	1.72	1.48	1.45	3.55	2.65	3.15	1.42	3.05	3.30	1.18	1.78	1.58
27	3.10	3.05	1.40	2.45	2.60	3.05	1.40	1.88	3.35	1.12	1.68	1.58
28	3.80	3.75	1.38	2.65	2.35	2.85	1.30	1.62	3.75	1.10	3.75	1.52
29	2.50	.....	1.45	2.35	2.65	2.75	1.28	4.15	3.35	1.10	3.35	1.60
30	1.90	.....	1.65	2.25	1.95	1.90	1.25	3.75	5.75	1.10	2.35	1.55
31	2.60	.....	2.65	.....	1.82	.....	1.20	2.80	.....	1.10	.....	1.65

Daily discharge, in second-feet, of Kailua Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	
2		12		22	
3		13		23	
4		14		24	147
5		15		25	53
6		16		26	265
7		17		27	32
8	150	18		28	
9	108	19		29	
10	86	20		30	
				31	38

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	62	30	23				26			80		
2	14	235	7.6				30			42		
3		120					14			30		
4	180	165				158	23			57		
5	188	52				68	20			47		
6	17	285				74	23			47		
7	20	52				68	14		20	105		
8		450				105	26		105	68		68
9		588			98	98	30			30		
10	120	825			63	112	42			14		
11	30	42				80	52		142	12		
12	38	34				38	52		47	7.6		
13	74	26				42	20					
14	14				23	34	20				47	135
15	8				74	128	23				34	255
16					68	23	20	23				128
17				57	44	14					120	80
18					47				86		17	135
19					9.8	26		150	9.8		17	112
20					7.6	20			188		80	47
21					52	14			34		128	14
22					26	17			98		142	
23				295	34	9.8			57		135	
24				245				12	92			
25	14			245				42	34			
26				86	9.8	42		34	57			
27	38	34			7.6	34			62			
28	120	112				20			112		112	
29					9.8	14		172	62		62	
30								112	512			
31	7.6							17				

NOTE.—Daily discharge for the days when the intake gate was closed and no water was being diverted determined from a rating curve fairly well defined below 150 second-feet. On days for which discharge is not given the intake gate was open, diverting water into the new Hamakua ditch, and no estimate could be made owing to insufficient measurements.

OANUI STREAM NEAR HUELO, MAUI.

Oanui Stream is tributary to Kailua Stream from the west, entering a short distance below the crossing of the new Hamakua ditch.

A gaging station was established on this stream just above the ditch crossing December 7, 1910. A staff gage, graduated to tenths of feet, is fastened to the left bank and is used to obtain gage heights. There is no good section for high-water measurements near the gage, but several hundred feet farther up, near the old Hamakua ditch, a fairly good section is obtained, and all the measurements were made

at this section from a footbridge. No measurements have been obtained at this station since January, 1911.

The discharge at this point gives the total flow of the stream above all diversions.

Discharge measurements of Oanui Stream near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 7	Pierce & Schulz	3.2	3.5	1.90	4.44
11	do	4.5	5.9	2.10	14.0
25	Pierce and Martin	3.5	3.8	1.90	6.4

NOTE.—Measurements made from footbridge near Old Hamakua ditch several hundred feet above gage.

Daily gage height, in feet, of Oanui Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11	1.8	21	1.7
2		12	1.75	22	1.7
3		13	1.75	23	1.7
4		14	1.7	24	1.95
5		15	1.7	25	1.95
6		16	1.7	26	2.5
7	2.3	17	1.7	27	1.9
8	1.9	18	1.7	28	1.9
9	1.85	19	1.7	29	1.75
10	1.8	20	1.7	30	1.7
				31	1.9

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	2.0	1.9	1.9	1.85	1.9	1.85	2.0	1.8	1.9	2.05	1.8	1.85
2	1.8	2.3	1.8	1.85	1.9	1.95	1.9	1.8	1.9	2.0	1.8	1.85
3	1.85	2.15	1.8	1.85	1.9	2.0	1.9	1.8	1.9	1.95	1.8	1.85
4	2.1	2.25	1.8	1.8	1.85	2.4	1.9	1.8	1.85	1.95	1.8	1.85
5	2.05	2.05	1.8	1.8	1.8	2.05	1.9	1.8	1.85	1.9	1.8	1.85
6	1.9	2.45	1.8	1.8	1.9	1.95	2.0	1.8	1.8	1.9	1.8	2.0
7	1.9	2.05	1.8	1.8	1.9	2.05	1.9	1.8	1.9	2.15	1.8	1.85
8	1.85	2.25	1.8	1.8	1.9	2.0	2.0	1.8	2.0	2.0	1.9	2.1
9	1.85	2.35	1.8	1.8	2.4	2.25	2.0	1.8	1.95	1.9	1.8	1.9
10	2.2	3.5	1.8	1.8	2.35	2.35	2.15	1.8	1.9	1.9	1.8	1.85
11	2.0	2.05	1.8	1.8	1.95	2.0	2.05	1.8	2.2	1.9	1.8	1.85
12	2.05	1.95	1.8	1.8	1.9	1.95	2.0	1.8	2.0	1.85	1.8	1.85
13	2.1	1.9	1.8	1.8	2.0	2.05	1.9	1.8	1.9	1.85	1.9	1.85
14	1.9	1.9	1.85	1.8	2.15	2.0	1.9	1.8	1.9	1.85	2.2	2.0
15	1.9	1.9	1.85	1.8	2.15	1.9	2.0	1.8	1.9	1.85	1.95	2.1
16	1.9	1.9	1.8	1.8	2.15	1.95	1.9	1.85	1.9	1.85	1.8	2.0
17	1.85	1.85	1.8	1.95	2.0	1.9	1.9	1.9	1.9	1.85	2.2	1.9
18	1.85	1.85	1.8	1.95	2.0	1.9	1.85	1.85	2.05	1.85	2.0	2.0
19	1.85	1.8	1.85	1.9	1.9	1.9	1.85	2.35	1.9	1.8	1.9	2.0
20	1.85	1.8	1.85	1.9	1.9	1.9	1.9	1.9	2.25	1.8	1.9	1.9
21	1.8	1.8	1.8	2.25	2.0	1.9	1.85	1.85	1.7	1.8	2.15	1.9
22	1.8	1.8	1.8	1.9	2.0	1.9	1.85	1.8	2.1	1.8	2.1	1.85
23	1.8	1.8	1.8	2.45	1.95	1.9	1.85	1.8	2.05	1.8	2.05	1.85
24	1.95	1.8	1.8	2.55	1.95	1.9	1.8	1.9	2.05	1.8	1.95	2.0
25	1.9	1.8	1.8	2.55	1.95	1.9	1.8	2.0	2.0	1.8	1.9	1.85
26	1.9	1.8	1.8	2.35	1.95	2.0	1.8	1.95	2.2	1.8	1.8	1.85
27	2.05	2.05	1.8	2.0	1.9	1.95	1.8	1.9	2.0	1.8	1.8	1.85
28	2.3	2.0	1.8	1.9	1.85	1.9	1.8	1.85	2.2	1.8	2.2	1.85
29	1.9	.....	1.8	1.9	1.9	1.9	1.8	2.5	2.0	1.8	2.0	1.85
30	1.9	.....	1.8	1.9	1.85	1.9	1.8	2.1	3.6	1.8	1.85	1.85
31	1.9	.....	1.9	.....	1.85	.....	1.8	1.9	.....	1.8	.....	1.85

Daily discharge, in second-feet, of Oanui Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11	3.5	21	1.0
2		12	2.2	22	1.0
3		13	2.2	23	1.0
4		14	1.0	24	8.0
5		15	1.0	25	8.0
6		16	1.0	26	35
7	22	17	1.0	27	6.5
8	6.5	18	1.0	28	6.5
9	5.0	19	1.0	29	2.2
10	3.5	20	1.0	30	1.0
				31	6.5

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	9.5	6.5	6.5	5.0	6.5	5.0	9.5	3.5	6.5	11	3.5	5.0
2	3.5	22	3.5	5.0	6.5	8.0	6.5	3.5	6.5	9.5	3.5	5.0
3	5.0	15	3.5	5.0	6.5	9.5	6.5	3.5	6.5	8.0	3.5	5.0
4	13	20	3.5	3.5	5.0	28	6.5	3.5	5.0	8.0	3.5	5.0
5	11	11	3.5	3.5	3.5	11	6.5	3.5	5.0	6.5	3.5	5.0
6	6.5	32	3.5	3.5	6.5	8.0	9.5	3.5	3.5	6.5	3.5	9.5
7	6.5	11	3.5	3.5	6.5	11	6.5	3.5	6.5	15	3.5	5.0
8	5.0	20	3.5	3.5	6.5	9.5	9.5	3.5	9.5	9.5	6.5	13
9	5.0	25	3.5	3.5	28	20	9.5	3.5	8.0	6.5	3.5	6.5
10	17	118	3.5	3.5	25	25	15	3.5	6.5	6.5	3.5	5.0
11	9.5	11	3.5	3.5	8.0	9.5	11	3.5	17	6.5	3.5	5.0
12	11	8.0	3.5	3.5	6.5	8.0	9.5	3.5	9.5	5.0	3.5	5.0
13	13	6.5	3.5	3.5	9.5	11	6.5	3.5	6.5	5.0	6.5	5.0
14	6.5	6.5	5.0	3.5	15	9.5	6.5	3.5	6.5	5.0	17	9.5
15	6.5	6.5	5.0	3.5	15	6.5	9.5	3.5	6.5	5.0	8.0	13
16	6.5	6.5	3.5	3.5	15	8.0	6.5	5.0	6.5	5.0	3.5	9.5
17	5.0	5.0	3.5	8.0	9.5	6.5	6.5	6.5	6.5	5.0	17	6.5
18	5.0	5.0	3.5	8.0	9.5	6.5	5.0	5.0	11	5.0	9.5	9.5
19	5.0	3.5	5.0	6.5	6.5	6.5	5.0	25	6.5	3.5	6.5	9.5
20	5.0	3.5	5.0	6.5	6.5	6.5	6.5	6.5	20	3.5	6.5	6.5
21	3.5	3.5	3.5	20	9.5	6.5	5.0	5.0	1.0	3.5	15	6.5
22	3.5	3.5	3.5	6.5	9.5	6.5	5.0	3.5	13	3.5	13	5.0
23	3.5	3.5	3.5	32	8.0	6.5	5.0	3.5	11	3.5	11	5.0
24	8.0	3.5	3.5	39	8.0	6.5	3.5	6.5	11	3.5	8.0	9.5
25	6.5	3.5	3.5	39	8.0	6.5	3.5	9.5	9.5	3.5	6.5	5.0
26	6.5	3.5	3.5	25	8.0	9.5	3.5	8.0	17	3.5	3.5	5.0
27	11	11	3.5	9.5	6.5	8.0	3.5	6.5	9.5	3.5	3.5	5.0
28	22	9.5	3.5	6.5	5.0	6.5	3.5	5.0	17	3.5	17	5.0
29	6.5	.....	3.5	6.5	6.5	6.5	3.5	35	9.5	3.5	9.5	5.0
30	6.5	.....	3.5	6.5	5.0	6.5	3.5	13	128	3.5	5.0	5.0
31	6.5	.....	6.5	.....	5.0	.....	3.5	6.5	.....	3.5	.....	5.0

NOTE.—Daily discharge computed from a rating curve that is poorly defined.

Monthly discharge of Oanui Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 7–31	35	1.0	5.14	255	D.
1911.					
January	22	3.5	7.71	474	D.
February	118	3.5	13.7	761	D.
March	6.5	3.5	3.89	239	D.
April	39	3.5	9.33	555	D.
May	28	3.5	9.05	556	D.
June	28	5.0	9.44	561	D.
July	15	3.5	6.48	398	D.
August	35	3.5	6.53	402	D.
September	128	1.0	12.9	768	D.
October	15	3.5	5.61	345	D.
November	17	3.5	7.05	420	D.
December	13	5.0	6.58	405	D.
The year	128	1.0	8.13	5,880	

HOOLAWALIILII STREAM NEAR HUELO, MAUI.

Hoolawa Stream, which drains the area just west of Huelo Stream and east of Honopou, is one of the important streams supplying the East Maui ditches. It has two principal branches, known as Hoolawaliilii and Hoolawanui (small Hoolawa and large Hoolawa).

The gaging station was established on Hoolawaliilii Stream April 6, 1911, at a point about 400 feet above the crossing of the new Hamakua ditch about 1 mile east of Lupi and 3 miles, by trail, southwest of Kailua (Huelo post office).

A staff gage, graduated to tenths of a foot, is fastened to a rock wall on the right bank and is used to obtain gage heights. The channel has a rocky floor and is not subject to change. Only wading measurements have been made.

The discharge at this station gives the total flow of the stream above the Hamakua ditches.

Discharge measurements of Hoolawaliilii Stream near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 5	C. H. Pierce	16.2	12.7	0.15	3.63

NOTE.—Additional measurements made early in 1912 have been used for obtaining a rating. Measurements made by wading near the gage.

Daily gage height, in feet, of Hoolawaliilii Stream near Huelo, Maui, for 1911.

[Oniye, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.24	0.18	0.22	0.15	0.26	0.58	0.11	0.22
2	.....	.24	.23	.22	.14	.27	.44	.11	.20
3	.....	.22	.39	.22	.12	.23	.36	.11	.19
4	.....	.20	.32	.24	.12	.20	.33	.10	.20
5	.....	.20	.48	.21	.12	.18	.30	.10	.17
6	0.16	.23	.32	.26	.12	.17	.25	.11	.31
7	.16	.22	.52	.26	.12	.20	.43	.11	.25
8	.16	.19	.39	.27	.11	.29	.37	.20	.34
9	.16	.54	.40	.28	.11	.26	.29	.12	.22
10	.15	.58	.56	.26	.11	.22	.26	.12	.22
11	.15	.34	.40	.34	.11	.40	.22	.11	.20
12	.15	.31	.32	.30	.12	.30	.21	.11	.19
13	.15	.32	.38	.27	.12	.24	.26	.15	.19
14	.14	.36	.34	.26	.11	.22	.19	.24	.32
15	.13	.44	.28	.27	.11	.21	.18	.22	.34
16	.13	.43	.29	.28	.15	.20	.17	.21	.33
17	.24	.41	.25	.24	.15	.20	.18	.36	.32
18	.24	.36	.24	.22	.14	.34	.16	.28	.30
19	.18	.24	.26	.20	.40	.28	.14	.25	.32
20	.20	.24	.24	.22	.22	.42	.14	.22	.25
21	.45	.36	.28	.22	.16	.32	.14	.35	.22
22	.30	.28	.26	.19	.16	.46	.13	.36	.22
23	.56	.23	.23	.19	.15	.60	.13	.35	.20
24	.48	.22	.22	.18	.20	.54	.12	.32	.32
25	.61	.22	.22	.16	.28	.38	.12	.28	.30
26	.60	.22	.26	.15	.30	.43	.13	.24	.22
27	.41	.20	.25	.14	.24	.40	.12	.22	.21
28	.33	.20	.24	.14	.20	.60	.12	.38	.20
29	.27	.20	.23	.14	.48	.41	.12	.31	.20
30	.24	.20	.22	.14	.43	1.45	.11	.26	.20
31	.....	.20	.....	.14	.30	.....	.11	.....	.18

Daily discharge, in second-feet, of Hoolawaliilii Stream near Huelo, Maui, for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.0	4.5	5.5	3.8	6.5	15	2.8	5.5
2	.....	6.0	5.8	5.5	3.5	6.8	11	2.8	5.0
3	.....	5.5	9.8	5.5	3.0	5.8	9.0	2.8	4.8
4	.....	5.0	8.0	6.0	3.0	5.0	8.2	2.5	5.0
5	.....	5.0	12	5.2	3.0	4.5	7.5	2.5	4.2
6	4.0	5.8	8.0	6.5	3.0	4.2	6.2	2.8	7.8
7	4.0	5.5	14	6.5	3.0	5.0	11	2.8	6.2
8	4.0	4.8	9.8	6.8	2.8	7.2	9.2	5.0	8.5
9	4.0	14	10	7.0	2.8	6.5	7.2	3.0	5.5
10	3.8	15	15	6.5	2.8	5.5	6.5	3.0	5.5
11	3.8	8.5	10	8.5	2.8	10	5.5	2.8	5.0
12	3.8	7.8	8.0	7.5	3.0	7.5	5.2	2.8	4.8
13	3.8	8.0	10	6.8	3.0	6.0	5.0	3.8	4.8
14	3.5	9.0	8.5	6.5	2.8	5.5	4.8	6.0	8.0
15	3.2	11	7.0	6.8	2.8	5.2	4.5	5.5	8.5
16	3.2	11	7.2	7.0	3.8	5.0	4.2	5.2	8.2
17	6.0	10	6.2	6.0	3.8	5.0	4.5	9.0	8.0
18	6.0	9.0	6.0	5.5	3.5	8.5	4.0	7.0	7.5
19	4.5	6.0	6.5	5.0	10	7.0	3.5	6.2	8.0
20	5.0	6.0	6.0	5.5	5.5	11	3.5	5.5	6.2
21	12	9.0	7.0	5.5	4.0	8.0	3.5	8.8	5.5
22	7.5	7.0	6.5	4.8	4.0	12	3.2	9.0	5.5
23	15	5.8	5.8	4.8	3.8	16	3.2	8.8	5.0
24	12	5.5	5.5	4.5	5.0	14	3.0	8.0	8.0
25	16	5.5	5.5	4.0	7.0	9.5	3.0	7.0	7.5
26	16	5.5	6.5	3.8	7.5	11	3.2	6.0	5.5
27	10	5.0	6.2	3.5	6.0	10	3.0	5.5	5.2
28	8.2	5.0	6.0	3.5	5.0	16	3.0	9.5	5.0
29	6.8	5.0	5.8	3.5	12	10	3.0	7.8	5.0
30	6.0	5.0	5.5	3.5	11	42	2.8	6.5	5.0
31	.....	5.0	.....	3.5	7.5	.....	2.8	.....	4.5

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 12 second-feet.

Monthly discharge of Hoolawaliilii Stream near Huelo, Maui, for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 6–30	16	3.2	6.88	341	B.
May	15	4.8	7.17	441	B.
June	15	4.5	7.75	461	B.
July	8.5	3.5	5.52	339	B.
August	12	2.8	4.66	287	B.
September	42	4.2	9.21	548	B.
October	15	2.8	5.46	336	B.
November	9.5	2.5	5.36	319	B.
December	8.5	4.2	6.09	374	B.
The period	42	2.5	6.43	3,450	

HOOLAWANUI STREAM NEAR HUELO, MAUI.

A gaging station was established on Hoolawanui Stream December 12, 1910. The station is about 250 feet above the new Hamakua ditch crossing and is about one-fourth mile east of Lupi and 3½ miles, by trail, southwest of Kailua (Huelo post office).

A staff gage, graduated in tenths of a foot, is fastened to the left end of an old concrete weir which forms the control. No measurements were made at this station during 1910–11, but measurements made early in 1912 have been used for obtaining a rating.

The records show the total flow of the stream above the Hamakua ditches.

Daily gage height, in feet, of Hoolawanui Stream near Huelo, Maui, for 1910–11.

[Oniye, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.					
1		11		21	0.15
2		12	0.30	22	.20
3		13	.25	23	.15
4		14	.25	24	.95
5		15	.20	25	.5
6		16	.20	26	1.7
7		17	.20	27	.6
8		18	.15	28	.4
9		19	.20	29	.3
10		20	.20	30	.3
				31	.45

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.45	0.3	0.35	0.2	0.25	0.2	0.3	0.15	0.3	0.75	0.1	0.3
2	.3	1.0	.25	.2	.3	.25	.3	.15	.3	.5	.1	.25
3	.25	.7	.25	.2	.25	.4	.25	.1	.25	.45	.1	.25
4	.55	.65	.2	.15	.2	.35	.3	.1	.25	.45	.1	.25
5	.55	.55	.2	.15	.2	.6	.25	.1	.2	.4	.1	.2
6	.35	1.3	.2	.15	.3	.4	.35	.1	.2	.3	.1	.4
7	.3	.7	.2	.15	.25	.8	.3	.1	.2	.55	.1	.3
8	.3	1.0	.15	.15	.25	.6	.3	.1	.3	.45	.25	.5
9	.3	1.75	.15	.15	.7	.6	.35	.1	.25	.35	.1	.25
10	.7	3.0	.2	.1	.8	.8	.3	.1	.25	.3	.1	.25
11	.4	1.1	.15	.1	.45	.55	.4	.1	.5	.3	.1	.2
12	.4	.6	.15	.1	.35	.4	.4	.1	.4	.3	.1	.2
13	.55	.55	.15	.1	.35	.5	.3	.1	.3	.25	.15	.2
14	.4	.45	.15	.1	.45	.45	.3	.1	.25	.2	.35	.4
15	.3	.3	.25	.1	.75	.35	.3	.1	.25	.2	.3	.4

Daily gage height, in feet, of Hoolawanui Stream near Huelo, Maui, for 1910–11—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	0.4	0.3	0.2	0.1	0.65	0.35	0.3	0.2	0.25	0.2	0.25	0.45
17	.3	.25	.2	.3	.45	.3	.3	.15	.3	.2	.55	.5
18	.25	.25	.15	.3	.4	.3	.25	.1	.6	.2	.35	.5
19	.2	.25	.25	.2	.3	.3	.2	.6	.3	.15	.25	.5
20	.2	.25	.2	.25	.3	.3	.25	.25	.65	.15	.25	.35
21	.2	.2	.15	.6	.4	.3	.2	.15	.4	.15	.5	.3
22	.2	.2	.15	.4	.35	.3	.2	.15	.6	.15	.65	.3
23	.15	.2	.15	.9	.35	.3	.2	.15	.55	.15	.55	.25
24	.3	.2	.15	.75	.3	.25	.2	.25	.75	.15	.4	.45
25	.25	.15	.15	1.0	.25	.25	.2	.3	.4	.1	.35	.35
26	.2	.15	.15	.7	.25	.3	.2	.35	.5	.15	.35	.25
27	.2	.5	.15	.5	.25	.3	.15	.25	.45	.1	.25	.2
28	.65	.6	.1	.4	.25	.3	.15	.2	.7	.1	.5	.2
29	.35	.....	.1	.3	.35	.3	.15	.6	.5	.1	.4	.2
30	.25	.....	.2	.3	.25	.25	.15	.45	1.9	.1	.3	.2
31	.35	.....	.2	.....	.2	.....	.15	.3	.....	.1	.....	.2

Daily discharge, in second-feet, of Hoolawanui Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	.....	11	.....	21	5
2	.....	12	12	22	7
3	.....	13	10	23	5
4	.....	14	10	24	82
5	.....	15	7	25	26
6	.....	16	7	26	217
7	.....	17	7	27	36
8	.....	18	5	28	18
9	.....	19	7	29	12
10	.....	20	7	30	12
				31	22

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	22	12	15	7	10	7	12	5	12	54	3	12
2	12	90	10	7	12	10	12	5	12	26	3	10
3	10	48	10	7	10	18	10	3	10	22	3	10
4	31	42	7	5	7	15	12	3	10	22	3	10
5	31	31	7	5	7	36	10	3	7	18	3	7
6	15	141	7	5	12	18	15	3	7	12	3	18
7	12	48	7	5	10	61	12	3	7	31	3	12
8	12	90	5	5	10	36	12	3	12	22	10	26
9	12	226	5	5	48	36	15	3	10	15	3	10
10	48	476	7	3	61	61	12	3	10	12	3	10
11	18	106	5	3	22	31	18	3	26	12	3	7
12	18	36	5	3	15	18	18	3	18	12	3	7
13	31	31	5	3	15	26	12	3	12	10	5	7
14	18	22	5	3	22	22	12	3	10	7	15	18
15	12	12	10	3	54	15	12	3	10	7	12	18
16	18	12	7	3	42	15	12	7	10	7	10	22
17	12	10	7	12	22	12	12	5	12	7	31	26
18	10	10	5	12	18	12	10	3	36	7	15	26
19	7	10	10	7	12	12	7	36	12	5	10	26
20	7	10	7	10	12	12	10	10	42	5	10	15
21	7	7	5	36	18	12	7	5	18	5	26	12
22	7	7	5	18	15	12	7	5	36	5	42	12
23	5	7	5	75	15	12	7	5	31	5	31	10
24	12	7	5	54	12	10	7	10	54	5	18	22
25	10	5	5	90	10	10	7	12	18	3	15	15
26	7	5	5	48	10	12	7	15	26	5	15	10
27	7	26	5	26	10	12	5	10	22	3	10	7
28	42	36	3	18	10	12	5	7	48	3	26	7
29	15	.....	3	12	15	12	5	36	26	3	18	7
30	10	.....	7	12	10	10	5	22	256	3	12	7
31	15	.....	7	.....	7	.....	5	12	.....	3	.....	7

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 40 second-feet.

Monthly discharge of Hoolawanui Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 12–31	217	5	25.7	1,020	C.
1911.					
January	48	5	15.9	978	B.
February	476	5	55.8	3,100	C.
March	15	3	6.48	398	B.
April	90	3	16.7	994	B.
May	61	7	17.8	1,090	B.
June	61	7	19.6	1,170	B.
July	18	5	10.1	621	B.
August	36	3	8.03	494	B.
September	256	7	27.3	1,620	B.
October	54	3	11.5	707	B.
November	42	3	12.1	720	B.
December	26	7	13.3	818	B.
The year	476	3	17.6	12,700	

HONOPOU STREAM NEAR HUELO, MAUI.

Honopou Stream is just west of Halawa Stream in the East Maui ditch country. The water of this stream is intercepted by the old and new Hamakua ditches, which take the entire flow at low and medium stages; at higher stages water passes down to the Lowrie and Haiku ditches below.

A gaging station was established on this stream December 10, 1910, at a point about 250 feet above the new Hamakua ditch crossing, about three-fourths of a mile west of Lupi and 4 miles southwest of Kailua (Huelo post office).

A staff gage, graduated in tenths of a foot, is fastened to the upstream side of an old concrete weir and is used to obtain gage heights.

No measurements were made at this station during 1910–11, but measurements made early in 1912 have been used for obtaining a rating.

The discharge gives the total flow of the stream above the new Hamakua ditch.

Daily gage height, in feet, of Honopou Stream near Huelo, Maui, for 1910–11.

[Oniye, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	0.2
2		12	0.4	22	.2
3		13	.4	23	.2
4		14	.35	24	1.3
5		15	.3	25	.5
6		16	.3	26	1.9
7		17	.25	27	.6
8		18	.25	28	.5
9		19	.25	29	.4
10		20	.2	30	.35
				31	.55

Daily gage height, in second-feet, of Honopou Stream, near Huelo, Maui, for 1910–11—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.55	0.4	0.45	0.2	0.35	0.2	0.35	0.15	0.3	0.75	0.1	0.3
2	.35	.8	.3	.2	.35	.35	.25	.15	.3	.6	.1	.3
3	.35	.7	.3	.2	.3	.5	.3	.1	.25	.55	.1	.3
4	.4	.65	.25	.2	.25	.45	.3	.1	.25	.55	.1	.25
5	.4	.5	.2	.15	25	.6	.3	.1	.2	.5	.1	.25
6	.36	1.3	.2	.15	.3	.45	.3	.1	.2	.4	.1	.4
7	.3	.8	.2	.15	.25	.7	.3	.1	.25	.55	.1	.3
8	.3	.9	.2	.15	.25	.5	.35	.1	.4	.5	.1	.5
9	.3	1.0	.2	.15	.7	.55	.4	.1	.3	.4	.1	.25
10	.55	2.3	.2	.15	.8	.85	.3	.1	.25	.35	.1	.25
11	.4	1.35	.15	.15	.5	.6	.4	.1	.5	.35	.1	.25
12	.4	.7	.15	.1	.45	.55	.4	.1	.4	.3	.1	.2
13	.4	.55	.15	.1	.4	.5	.3	.1	.3	.3	.15	.2
14	.35	.45	.15	.1	.5	.5	.3	.1	.25	.3	.55	.4
15	.3	.45	.25	.1	.7	.4	.4	.1	.3	.25	.25	.5
16	.4	.4	.2	.1	.6	.45	.4	.15	.3	.25	.2	.45
17	.35	.35	.2	.3	.5	.35	.3	.1	.3	.25	.55	.45
18	.3	.3	.2	.3	.45	.35	.3	.1	.4	.2	.4	.45
19	.3	.25	.35	.2	.4	.35	.25	.5	.3	.2	.3	.45
20	.25	.3	.25	.25	.4	.3	.25	.25	.6	.2	.25	.35
21	.2	.25	.2	.5	.5	.3	.25	.2	.4	.2	.45	.3
22	.2	.2	.2	.35	.35	.35	.2	.1	.55	.15	.5	.3
23	.2	.2	.2	1.0	.3	.25	.2	.1	.55	.15	.5	.3
24	.45	.2	.15	.6	.3	.25	.2	.25	.7	.15	.4	.5
25	.25	.2	.15	.9	.3	.25	.2	.4	.4	.15	.35	.35
26	.2	.2	.15	.7	.3	.3	.2	.3	.55	.15	.3	.25
27	.2	.55	.15	.6	.25	.3	.15	.25	.7	.15	.25	.25
28	.6	.65	.15	.5	.25	.3	.15	.2	.75	.15	.5	.25
29	.4	.....	.15	.4	.3	.25	.15	.55	.5	.1	.35	.25
30	.3	.....	.2	.4	.25	.25	.15	.5	2.2	.1	.3	.2
31	.4	.....	.2	.....	.25	.....	.15	.35	.....	.1	.....	.2

Daily discharge, in second-feet, of Honopou Stream near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1	.....	11	.....	21	3.0
2	.....	12	8.0	22	3.0
3	.....	13	8.0	23	3.0
4	.....	14	6.6	24	53
5	.....	15	5.2	25	11
6	.....	16	5.2	26	94
7	.....	17	4.1	27	15
8	.....	18	4.1	28	11
9	.....	19	4.1	29	8.0
10	.....	20	3.0	30	6.6
				31	13

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	13	8.0	9.5	3.0	6.6	3.0	6.6	2.2	5.2	22	1.3	5.2
2	6.6	24	5.2	3.0	6.6	6.6	4.1	2.2	5.2	15	1.3	5.2
3	6.6	19	5.2	3.0	5.2	11	5.2	1.3	4.1	13	1.3	5.2
4	8.0	17	4.1	3.0	4.1	9.5	5.2	1.3	4.1	13	1.3	4.1
5	8.0	11	3.0	2.2	4.1	15	5.2	1.3	3.0	11	1.3	4.1
6	6.6	53	3.0	2.2	5.2	9.5	5.2	1.3	3.0	8.0	1.3	8.0
7	5.2	24	3.0	2.2	4.1	19	5.2	1.3	4.1	13	1.3	5.2
8	5.2	29	3.0	2.2	4.1	11	6.6	1.3	8.0	11	1.3	11
9	5.2	35	3.0	2.2	19	13	8.0	1.3	5.2	8.0	1.3	4.1
10	13	131	3.0	2.2	24	26	5.2	1.3	4.1	6.6	1.3	4.1
11	8.0	56	2.2	2.2	11	15	8.0	1.3	11	6.6	1.3	4.1
12	8.0	19	2.2	1.3	9.5	13	8.0	1.3	8.0	5.2	1.3	3.0
13	8.0	13	2.2	1.3	8.0	11	5.2	1.3	5.2	5.2	2.2	3.0
14	6.6	9.5	2.2	1.3	11	11	5.2	1.3	4.1	5.2	13	8.0
15	5.2	9.5	4.1	1.3	19	8.0	8.0	1.3	5.2	4.1	4.1	11

Daily discharge, in second-feet, of Honopou Stream, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
16	8.0	8.0	3.0	1.3	15	9.5	8.0	2.2	5.2	4.1	3.0	9.5
17	6.6	6.6	3.0	5.2	11	6.6	5.2	1.3	5.2	4.1	13	9.5
18	5.2	5.2	3.0	5.2	9.5	6.6	5.2	1.3	8.0	3.0	8.0	9.5
19	5.2	4.1	6.6	3.0	8.0	6.6	4.1	11	5.2	3.0	5.2	9.5
20	4.1	5.2	4.1	4.1	8.0	5.2	4.1	4.1	15	3.0	4.1	6.6
21	3.0	4.1	3.0	11	11	5.2	4.1	3.0	8.0	3.0	9.5	5.2
22	3.0	3.0	3.0	6.6	6.6	6.6	3.0	1.3	13	2.2	11	5.2
23	3.0	3.0	3.0	35	5.2	4.1	3.0	1.3	13	2.2	11	5.2
24	9.5	3.0	2.2	15	5.2	4.1	3.0	4.1	19	2.2	8.0	11
25	4.1	3.0	2.2	29	5.2	4.1	3.0	8.0	8.0	2.2	6.6	6.6
26	3.0	3.0	2.2	19	5.2	5.2	3.0	5.2	13	2.2	5.2	4.1
27	3.0	13	2.2	15	4.1	5.2	2.2	4.1	19	2.2	4.1	4.1
28	15	17	2.2	11	4.1	5.2	2.2	3.0	22	2.2	11	4.1
29	8.0	.....	2.2	8.0	5.2	4.1	2.2	13	11	1.3	6.6	4.1
30	5.2	.....	3.0	8.0	4.1	4.1	2.2	11	120	1.3	5.2	3.0
31	8.0	.....	3.0	.....	4.1	.....	2.2	6.6	.....	1.3	.....	3.0

NOTE.—Daily discharge computed from a rating curve that is fairly well defined below 15 second-feet.

Monthly discharge of Honopou Stream near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
December 12–31	94	3.0	13.4	532	C.
1911.					
January	15	3.0	6.68	411	B.
February	131	3.0	19.2	1,070	C.
March	9.5	2.2	3.32	204	B.
April	35	1.3	6.97	415	B.
May	24	4.1	8.16	502	B.
June	26	3.0	8.80	524	B.
July	8.0	2.2	4.76	293	B.
August	13	1.3	3.28	202	B.
September	120	3.0	12.1	720	C.
October	22	1.3	6.01	370	B.
November	13	1.3	4.88	290	B.
December	11	3.0	5.98	368	B.
The year	131	1.3	7.41	5,370	

HALEHAKU STREAM NEAR HUELO, MAUI.

Halehaku is one of the large gulches on the northern slope of Haleakala crossed by the East Maui ditches. As is often the case in Hawaii, this gulch has various names in different places, and at the crossing of the Government road about 2 miles from the sea it is known as Kakipi. The principal tributary of Halehaku Stream is Opana Stream, which joins it from the west below the old and new Hamakua ditches and above the Lowrie ditch.

The gaging station on this stream was established December 13, 1910, for the purpose of determining the amount of flood water not diverted by the new Hamakua ditch. It is about 3½ miles west of Lupi and about 7 miles, by trail, west of Kailua (Huelo post office), at the dam formed by the crossing of the new Hamakua ditch.

A staff gage, graduated in tenths of a foot, is fastened to the left side wall of the dam. Readings of this gage give the depth of water passing over the crest of the dam, which is used as a broad crested weir for obtaining discharge measurements. No current-meter measurements were made at this station during 1910–11.

The ordinary flow of the stream is taken into the new Hamakua ditch over a weir at the east end of the dam.

Daily discharge, in second-feet, of Halehaku Stream at dam near Huelo, Maui, for 1910–11.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	0.0
2		12		22	.0
3		13	0.0	23	.0
4		14	.0	24	1.9
5		15	.0	25	.0
6		16	.0	26	74
7		17	.0	27	1.3
8		18	.0	28	.0
9		19	.0	29	.0
10		20	.0	30	.0
				31	.0

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0
2	.0	8.4	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.0
3	.0	5.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4	.2	3.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5	3.4	1.6	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0
6	.0	4.6	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7	.0	4.6	.0	.0	.0	1.9	.0	.0	.0	.3	.0	.0
8	.0	17	.0	.0	.0	1.6	.0	.0	.0	.0	.0	.0
9	.0	20	.0	.0	.3	1.6	.0	.0	.0	.0	.0	.0
10	4.0	214	.0	.0	6.5	7.3	.0	.0	.0	.0	.0	.0
11	.0	3.6	.0	.0	.0	.6	.0	.0	.6	.0	.0	.0
12	.0	9.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
13	.0	3.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
14	.0	1.0	.0	.0	1.3	.0	.0	.0	.0	.0	.0	.0
15	.0	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0	1.3
16	.0	.0	.0	.0	2.2	.0	.0	.0	.0	.0	.0	.3
17	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
18	.0	.0	.0	.0	.0	.0	.0	.0	.3	.0	.0	.0
19	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
20	.0	.0	.0	.0	.0	.0	.0	.0	1.3	.0	.0	.0
21	.0	.0	.0	.8	.0	.0	.0	.0	.0	.0	.0	.0
22	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.3	.0
23	.0	.0	.0	6.9	.0	.0	.0	.0	.0	.0	1.4	.0
24	.0	.0	.0	8.0	.0	.0	.0	.0	.0	.0	.0	.0
25	.0	.0	.0	14	.0	.0	.0	.0	.0	.0	.0	.0
26	.0	.0	.0	8.4	.0	.0	.0	.0	.0	.0	.0	.0
27	.0	.0	.0	1.6	.0	.0	.0	.0	.0	.0	.0	.0
28	1.6	1.1	.0	.0	.0	.0	.0	.0	.0	.0	2.2	.0
29	.0	.....	.0	.0	.0	.0	.0	1.3	.0	.0	.0	.0
30	.0	.....	.0	.0	.0	.0	.0	.0	11	.0	.0	.0
31	.0	.....	.0	.....	.0	.....	.0	.0	.....	.0	.....	.0

NOTE.—Daily discharge computed from formula for a broad-crested weir, using a coefficient of 3.2. This coefficient was determined from current-meter ratings of a broad-crested weir of similar section.

Monthly discharge of Halehaku Stream at dam near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 13–31	74	0.0	4.06	153
January	4	.0	.30	18.4
February	214	.0	10.6	589
March	.0	.0	.0	.0
April	14	.0	1.32	78.6
May	6.5	.0	.34	20.9
June	7.3	.0	.43	25.6
July	.0	.0	.0	.0
August	1.3	.0	.04	2.5
September	11	.0	.44	26.2
October	7.6	.0	.29	17.8
November	2.2	.0	.13	7.7
December	1.3	.0	.06	3.7
The year	214	0.0	1.09	790

HALEHAKU STREAM WEIR AT NEW HAMAKUA DITCH, NEAR HUELO, MAUI.

The total flow of Halehaku Stream at low and medium stages is diverted into the new Hamakua ditch. The water passes over a 6-foot Cippoletti weir and drops into the ditch below the measuring weir on the ditch.

The Maui Agricultural Co. keeps a record on this weir, and has kindly furnished the data for 1910–11.

Daily discharge, in second-feet, of Halehaku Stream weir at New Hamakua ditch, near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	6.7	26	5.9	20	9.4	17	6.2	4.6	7.3	6.5	2.8	20
2	6.2	20	6.4	20	19	20	6.1	4.8	6.3	13	2.6	20
3	5.7	19	14	20	14	19	6.7	16	6.8	19	2.5	20
4	9.0	18	20	20	20	15	16	20	6.2	12	5.4	20
5	19	16	18	20	18	12	9.1	15	5.7	8.0	2.8	20
6	18	13	13	19	18	11	8.4	13	5.1	7.3	2.2	20
7	14	11	12	17	20	14	9.9	10	4.8	7.9	2.2	20
8	11	10	9.6	20	19	14	7.3	9.9	4.5	7.1	2.0	20
9	9.3	9.3	8.2	20	17	17	6.8	9.0	4.0	8.2	1.9	20
10	8.8	8.2	7.4	16	16	17	6.2	8.0	3.9	16	1.9	18
11	9.3	7.9	7.0	15	15	18	6.5	7.4	3.7	11	1.9	16
12	16	12	6.7	12	13	19	6.4	9.3	3.3	8.5	1.6	14
13	20	15	6.1	11	11	20	5.3	15	3.1	7.3	1.6	12
14	20	10	5.9	9.8	10	20	8.2	13	2.9	6.5	1.6	10
15	19	9.0	5.3	9.4	12	20	19	11	2.8	5.7	1.6	9.5
16	18	7.8	4.8	8.5	15	20	20	9.4	2.6	6.3	1.6	8.2
17	17	7.4	4.5	15	11	20	18	8.2	2.6	5.1	4.0	7.6
18	19	7.4	4.5	17	10	17	14	7.3	2.5	4.6	5.4	7.4
19	20	6.7	6.8	13	9.9	15	11	7.1	2.3	4.3	5.6	7.1
20	18	5.7	14	11	8.8	16	10	14	2.2	4.6	3.4	6.5
21	18	8.5	16	9.9	7.9	15	9.0	20	2.2	4.6	2.8	6.0
22	20	19	17	9.2	7.3	13	8.5	16	2.0	7.0	2.2	5.7
23	20	15	20	9.2	7.7	11	7.7	12	2.0	6.5	3.9	5.6
24	19	12	20	8.7	7.3	10	7.1	12	2.2	4.3	12.0	17
25	17	9.8	20	14	6.3	9.3	7.6	15	2.0	3.9	4.0	17
26	16	8.4	20	20	5.6	8.5	6.2	11	1.9	3.6	2.9	18
27	16	7.4	20	14	5.3	8.0	5.6	11	1.7	3.2	2.8	20
28	13	6.9	19	11	5.0	7.3	5.4	14	1.4	3.6	11	17
29	13	.....	16	9.6	4.6	6.8	4.8	9.9	2.6	3.6	20	13
30	17	.....	13	8.7	5.4	6.5	4.3	9.0	1.3	2.9	18	11
31	20	.....	18	.....	19	.....	5.1	8.0	.....	2.8	.....	14

Daily discharge, in second-feet, of Halehaku Stream weir at New Hamakua ditch, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	12	13	15	5.6	11	6.3	8.5	3.1	6.8	20	2.5	9.8
2	9.9	20	11	5.1	10	7.0	7.9	3.1	5.7	20	2.3	8.4
3	10	20	8.8	6.2	8.7	8.0	7.7	2.8	5.4	18	2.2	7.6
4	16	20	7.7	5.0	7.9	15	8.7	2.5	5.1	17	1.9	7.0
5	19	20	7.1	4.3	8.2	19	9.1	2.3	4.3	15	1.9	7.3
6	18	20	6.7	4.2	7.6	13	9.7	2.2	4.0	14	2.3	6.2
7	14	20	6.0	4.0	7.9	18	9.3	1.9	5.3	20	2.5	6.8
8	10	20	5.4	3.7	7.9	20	9.3	1.9	11	18	3.4	11
9	9.3	20	5.0	3.4	15	20	9.6	1.9	7.8	15	1.9	6.8
10	19	20	5.0	3.1	20	20	9.6	1.6	6.7	12	1.7	6.0
11	18	20	4.6	3.1	18	20	11	1.6	17	11	1.7	5.7
12	16	20	4.3	2.8	16	19	11	2.0	12	9.8	1.9	5.4
13	18	20	4.3	2.6	14	18	9.8	2.8	8.7	8.8	3.4	5.7
14	15	20	4.6	2.5	20	16	8.8	1.6	7.4	8.0	7.3	13
15	12	17	7.6	2.5	19	13	9.0	1.7	7.3	7.6	9.4	21
16	11	15	4.8	3.6	20	12	8.5	3.6	6.7	6.8	4.3	20
17	11	13	4.3	11	18	12	7.1	2.5	8.5	7.0	16	18
18	9.1	11	4.2	7.6	16	11	6.5	2.3	15	5.9	9.3	17
19	8.2	9.9	9.1	7.4	14	11	6.2	9.8	9.9	5.3	7.3	19
20	7.3	9.6	5.9	9.9	13	9.9	6.5	5.1	18	4.8	8.5	16
21	6.5	8.7	5.0	14	12	11	5.6	2.9	14	4.5	17	14
22	6.2	7.6	4.3	15	12	9.6	5.6	2.5	16	4.2	23	11
23	5.9	7.1	3.9	18	13	8.0	5.1	2.5	15	3.9	19	10
24	8.0	7.1	3.7	20	10	7.4	4.6	5.1	16	3.6	16	13
25	6.5	7.1	3.4	20	9.3	7.3	4.3	8.1	12	3.2	12	11
26	5.7	6.7	3.3	20	8.8	8.7	3.9	6.8	17	3.4	9.8	7.7
27	8.2	16	3.3	20	7.7	9.1	3.6	3.9	17	3.1	9.4	7.1
28	18	18	3.1	17	7.4	7.9	3.2	3.7	19	2.8	19	6.8
29	9.9	.....	3.9	14	9.4	7.3	3.1	12	18	2.8	16	6.2
30	7.9	.....	8.0	13	8.2	6.8	3.1	16	20	2.6	12	5.6
31	9.0	.....	8.2	.....	8.0	.....	2.8	8.8	.....	2.5	.....	5.3

NOTE.—Daily discharge in second-feet computed by the Geological Survey from weir records of discharge in million gallons per 24 hours.

Monthly discharge of Halehaku Stream weir at New Hamakua ditch, near Huelo, Maui, for 1910–11.

Month.	Discharge, in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	20	5.7	15.3	941
February	20	5.7	11.4	633
March	20	4.5	12.2	750
April	20	8.5	14.3	851
May	20	4.6	11.9	732
June	20	6.5	14.5	863
July	20	4.3	8.79	540
August	20	4.6	11.3	695
September	7.3	1.3	3.40	202
October	19	2.8	6.93	426
November	20	1.6	4.47	266
December	20	5.6	14.2	873
The year	20	1.3	10.7	7,770
1911.				
January	19	5.7	11.4	701
February	20	6.7	15.2	844
March	15	3.1	5.85	360
April	20	2.5	8.95	533
May	20	7.4	12.2	750
June	20	6.3	12.4	738
July	11	2.8	7.05	433
August	16	1.6	4.15	255
September	20	4.0	11.2	666
October	20	2.5	9.05	556
November	23	1.7	8.16	486
December	21	5.3	10.2	627
The year	23	1.6	9.60	6,950

OPANA STREAM NEAR HUELO, MAUI.

Opana Stream is tributary to Halehaku Stream from the west. Its water is intercepted by the Old and New Hamakua ditches.

A gaging station was established on this stream December 13, 1910, at a point about 300 feet below the bridge on the trail crossing, about 150 feet above the ditch siphon, and 7½ miles west of Kailua (Huelo post office).

A staff gage, graduated in tenths of a foot, is fastened in an inclined position on the right bank and is used to obtain low-water gage heights. High-water readings are taken on a vertical gage fastened to a rock on the left bank.

This station gives flood data only, as the ordinary flow of the stream is diverted above by Opana ditch, which is a feeder to the New Hamakua ditch. No discharge measurements have been made.

Daily gage height, in feet, of Opana Stream near Huelo, Maui, for 1910–11.

[Hamamura, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1910.		1910.		1910.	
1		11		21	1.51
2		12		22	1.51
3		13	1.59	23	1.51
4		14	1.54	24	2.24
5		15	1.52	25	2.20
6		16	1.52	26	3.58
7		17	1.50	27	2.30
8		18	1.50	28	1.56
9		19	1.52	29	1.53
10		20	1.52	30	1.52
				31	1.62

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	1.54	1.54	1.53	1.55	1.44	1.48	1.51	1.40	1.46	2.82	1.46	1.50
2	1.53	3.41	1.52	1.50	1.52	1.50	1.49	1.40	1.42	1.92	1.45	1.48
3	1.53	2.40	1.52	1.59	1.50	1.54	1.48	1.40	1.40	1.66	1.45	1.48
4	3.04	2.06	1.51	1.50	1.48	1.64	1.48	1.40	1.39	1.62	1.44	1.49
5	3.26	1.80	1.50	1.45	1.46	1.60	1.49	1.40	1.39	1.58	1.44	1.49
6	2.00	2.55	1.51	1.43	1.46	1.56	1.52	1.40	1.39	1.60	1.44	1.49
7	1.64	2.05	1.50	1.43	1.47	1.82	1.49	1.40	1.46	1.70	1.45	1.50
8	1.56	4.62	1.50	1.43	1.46	2.31	1.50	1.40	1.58	1.60	1.47	1.52
9	1.54	4.83	1.50	1.42	2.94	2.00	1.50	1.40	1.57	1.60	1.44	1.49
10	2.08	6.75	1.50	1.42	3.08	2.78	1.52	1.40	1.50	1.58	1.44	1.49
11	1.60	4.12	1.49	1.42	1.95	2.16	1.52	1.40	2.35	1.54	1.44	1.48
12	1.58	2.06	1.49	1.42	1.53	1.58	1.53	1.40	1.58	1.53	1.44	1.48
13	1.62	1.84	1.49	1.42	1.52	1.54	1.52	1.40	1.48	1.53	1.45	1.48
14	1.57	1.61	1.50	1.42	1.84	1.55	1.50	1.40	1.44	1.52	1.48	1.80
15	1.56	1.60	1.52	1.42	2.23	1.54	1.52	1.40	1.41	1.51	1.56	2.52
16	1.54	1.58	1.51	1.41	2.25	1.51	1.50	1.42	1.44	1.51	1.48	2.24
17	1.54	1.57	1.50	1.57	1.71	1.49	1.48	1.40	1.46	1.50	2.12	1.76
18	1.54	1.56	1.49	1.52	1.61	1.48	1.48	1.40	1.66	1.50	1.58	2.20
19	1.52	1.56	1.52	1.48	1.56	1.51	1.48	1.48	1.51	1.50	1.52	2.14
20	1.52	1.55	1.52	1.52	1.53	1.50	1.47	1.46	2.00	1.50	1.54	1.64
21	1.51	1.54	1.48	1.50	1.52	1.52	1.47	1.40	1.61	1.50	2.06	1.54
22	1.51	1.52	1.47	1.50	1.52	1.50	1.47	1.40	1.94	1.49	2.46	1.50
23	1.51	1.52	1.46	2.14	1.51	1.50	1.47	1.39	1.68	1.49	2.45	1.50
24	1.53	1.52	1.44	2.56	1.50	1.50	1.46	1.42	1.76	1.49	1.59	1.78
25	1.52	1.52	1.42	2.67	1.49	1.49	1.44	1 48	1 75	1.48	1.54	1.59
26	1.52	1.51	1.42	2.00	1.48	1.52	1.42	1.48	1.68	1.48	1.52	1.50
27	1 52	1.54	1.44	1.70	1.47	1.51	1.41	1.41	1.55	1.18	1.50	1.48
28	2.26	1.54	1.43	1.54	1.47	1.50	1.40	1.40	1.62	1.47	2.01	1.48
29	1.59	.....	1.52	1.46	1.50	1.49	1.40	1.54	1.75	1.46	1.62	1.48
30	1.52	.....	1.54	1.45	1.50	1.48	1.40	2.05	3.20	1.46	1.52	1.48
31	1.52	.....	1.60	.....	1.48	.....	1.40	1.53	.....	1.46	.....	1.48

OPANA DITCH NEAR HUELO, MAUI.

The Opana ditch is a feeder for the New Hamakua ditch. It diverts water from Opana Stream several hundred feet above the bridge on the trail crossing, and at low and medium stages takes the entire flow of the stream.

The water is measured by a 6-foot Cippoletti weir just before it drops into the New Hamakua ditch, and the records for 1910–11 have been furnished to the Geological Survey by the Maui Agricultural Co.

This ditch and weir station are on the east side of Opana gulch.

Daily discharge, in second-feet, of Opana ditch near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	3.7	18	1.4	29	2.5	22	1.7	1.1	1.4	2.8	0.2	26
2	2.5	20	1.7	26	18	27	1.7	1.2	1.2	9.9	.2	30
3	1.3	17	8.8	24	11	17	1.9	14	1.2	18	.2	24
4	4.5	12	18	20	23	8.0	3.1	28	1.0	5.6	.6	24
5	21	9.5	14	16	19	4.2	3.1	15	1.0	2.6	.5	31
6	23	7.3	9.1	13	12	2.6	2.2	8.8	1.0	2.2	.3	31
7	14	4.8	5.6	11	29	5.6	3.2	4.6	.8	1.9	.2	31
8	8.2	3.4	2.8	17	22	4.6	1.9	2.2	.6	1.9	.2	29
9	5.7	2.8	2.0	15	18	5.7	1.9	1.9	.6	3.2	.2	22
10	4.0	2.5	1.9	11	15	8.2	1.7	1.9	.5	17	.2	16
11	4.3	2.3	1.5	7.3	11	6.0	1.7	1.6	.5	4.3	.2	12
12	7.4	12	1.4	5.3	8.0	9.4	1.6	2.2	.3	1.9	.2	9.0
13	24	16	1.4	3.9	5.6	12	1.4	7.4	.3	1.2	.2	6.7
14	23	6.5	1.4	3.0	4.0	8.2	2.9	4.2	.2	1.0	.2	5.4
15	23	3.4	1.2	2.6	3.2	20	23	3.1	.2	1.0	.2	4.2
16	22	2.3	.8	2.2	5.3	14	18	1.9	.2	1.1	.2	3.4
17	22	2.2	.8	4.5	5.0	7.4	12	1.6	.2	1.0	1.6	3.4
18	26	2.2	.6	14	2.9	8.5	4.8	1.4	.2	.8	2.2	3.1
19	24	1.9	1.9	10	2.5	5.7	2.9	1.2	.2	.8	2.2	2.5
20	20	1.7	1.0	6.2	2.0	5.4	2.5	5.0	.2	.6	1.0	2.0
21	18	3.6	19	6.5	1.7	4.8	2.2	20	.2	1.0	.3	1.9
22	24	24	17	3.2	1.6	3.7	2.0	9.7	.2	1.0	.2	1.7
23	22	14	19	2.6	1.9	3.1	1.9	3.6	.2	.8	1.1	1.7
24	16	6.5	22	2.5	1.7	3.1	1.7	3.4	.2	.8	6.0	2.6
25	11	2.9	18	9.6	1.4	2.9	1.7	9.0	.2	.6	1.1	19
26	7.9	2.0	18	18	1.4	2.5	1.7	3.2	.2	.6	.6	15
27	10	1.7	15	9.3	1.4	2.3	1.6	2.3	.2	.6	.3	21
28	13	1.5	11	4.3	1.1	2.0	1.4	2.3	1.6	.5	5.6	9.3
29	8.2	.....	8.1	2.6	1.1	1.9	1.2	1.7	1.9	.6	29	4.8
30	14	.....	5.4	1.9	2.8	1.7	1.1	1.9	16	.5	14	3.6
31	21	.....	14	.....	29	.....	1.1	1.6	.....	.3	.....	4.5
1911.												
1	3.2	4.0	4.8	7.6	3.1	1.9	3.2	0.4	0.7	25	0.2	2.1
2	2.3	19	3.9	7.4	4.2	2.0	2.2	.3	.4	14	1.7	1.9
3	3.7	18	3.2	8.5	2.8	2.3	1.9	.3	.3	10	.4	1.5
4	18	17	2.8	3.4	2.2	9.1	2.2	.3	.3	9.1	.2	1.7
5	18	14	2.3	1.9	2.0	11	2.5	.3	.3	8.8	.2	1.8
6	15	19	2.2	1.0	1.9	6.2	3.7	.2	.3	6.8	.4	1.5
7	13	20	2.0	.8	1.6	14	2.2	.2	1.0	16	.4	1.9
8	7.9	28	1.9	.8	2.0	20	2.6	.2	4.6	13	.5	5.0
9	7.1	28	1.6	.6	18	19	2.9	.2	4.8	5.9	.3	2.2
10	18	30	1.6	.6	25	21	3.1	.2	3.6	4.8	.3	1.5
11	12	26	1.4	.4	14	16	4.0	.0	19	3.2	.2	1.0
12	10	20	1.2	.3	5.7	8.7	3.2	.0	8.1	2.6	.2	1.0
13	12	18	1.1	.3	5.9	7.4	2.6	.3	1.7	2.3	.3	1.2
14	8.0	16	1.2	.3	20	7.7	2.0	.2	1.0	2.2	1.7	10
15	6.2	12	2.3	.3	18	6.5	2.3	.0	.6	2.0	9.4	16
16	5.0	9.1	1.7	.6	19	4.6	2.2	.8	1.1	1.7	2.0	21
17	4.5	6.8	1.4	5.0	12	3.4	1.6	.4	2.0	1.6	16	15
18	3.9	5.4	1.2	2.6	8.4	3.1	1.2	.3	8.7	1.6	5.1	20
19	2.5	4.3	6.7	2.0	4.8	3.2	1.1	1.6	3.2	1.4	2.3	22
20	2.0	3.4	3.6	2.6	3.0	2.8	1.0	1.7	18	1.2	3.6	14

Daily discharge, in second-feet, of Opana ditch near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
21	2.0	3.0	1.1	9.1	2.6	3.2	1.0	0.4	12	1.1	18	7.9
22	1.9	2.8	1.0	12	3.0	2.3	1.0	.3	16	1.0	22	5.6
23	1.9	2.6	1.0	21	3.0	2.2	1.0	.3	10	1.0	19	3.8
24	4.2	2.5	1.0	24	2.3	1.9	.8	1.1	16	.8	9.6	11
25	2.2	2.3	.8	25	2.0	1.9	.8	3.1	12	.8	3.7	5.1
26	1.9	2.8	.8	20	2.2	3.1	.8	2.9	7.3	.6	2.3	2.2
27	3.9	10	.8	15	1.9	3.2	.8	.8	9.4	.6	3.1	1.9
28	20	9.3	1.2	8.8	1.7	2.8	.8	.4	11	.6	18	1.8
29	7.6	.....	4.2	7.1	2.2	1.9	.6	7.7	13	.5	13	1.6
30	2.5	.....	5.6	4.5	2.2	1.6	.6	18	24	.4	4.6	1.5
31	2.3	.....	14	.....	1.9	.....	.3	4.0	.....	.3	.....	1.4

NOTE.—Daily discharge in second-feet computed by the Geological Survey from weir records of discharge in million gallons per 24 hours.

Monthly discharge of Opana ditch near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	26	1.3	14.5	892
February	24	1.5	7.29	405
March	22	.6	8.13	500
April	29	1.9	10.0	595
May	29	1.1	8.52	524
June	27	1.7	7.65	455
July	23	1.1	3.57	220
August	28	1.1	5.39	331
September	16	.2	1.09	64.9
October	18	.3	2.78	171
November	29	.2	2.31	137
December	31	1.7	1.34	824
The year	31	.2	7.01	5,120
1911.				
January	20	1.9	7.18	441
February	30	2.3	12.6	700
March	14	.8	2.57	158
April	25	.3	6.45	384
May	25	1.6	6.41	394
June	21	1.6	6.47	485
July	4.0	.3	1.81	111
August	18	.0	1.51	92.8
September	24	.3	7.01	417
October	25	.3	4.55	280
November	22	.2	5.29	315
December	22	1.0	6.00	369
The year	30	.0	5.59	4,150

NEW HAMAKUA DITCH AT NAILIILIHAELE WEIR, NEAR HUELO, MAUI.

New Hamakua ditch heads at the Alo division weir and receives two-thirds of the water delivered by the Koolau ditch at that point. It runs through an almost continuous tunnel from the division weir to Nailiilihaele Stream without intercepting any water on the way.

The Maui Agricultural Co. maintains a 17-foot Cippoletti weir just above where the ditch crosses Nailiilihaele Stream. This weir shows the total flow of the ditch before water is taken in from Nailiilihaele Stream just below. A clock register is used to record the head on the weir. The records for 1910–11 have been furnished to the Geological Survey by the Maui Agricultural Co.

Discharge measurements of New Hamakua ditch at Nailiilihaele weir, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 7	C. H. Pierce	7.4	18.4	0.62	26.9
7	do	7.2	15.3	0.37	12.3
7	do	7.4	16.9	0.51	19.5
Dec. 9	J. B. Stewart	9.0	28.3	1.12	18.5

NOTE.—Gage heights obtained by measuring the head on 17-foot Cippoletti weir. Measurements made at upper end of first tunnel above the weir.

Daily discharge, in second-feet, of New Hamakua ditch at Nailiilihaele weir, near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910												
1	41	88	38	86	64	87	49	43	44	75	20	78
2	32	89	38	88	86	91	48	40	40	83	19	36
3	27	88	73	88	82	88	57	78	42	86	18	87
4	36	87	88	86	87	85	85	89	40	76	28	90
5	83	84	84	84	85	86	82	85	38	51	19	91
6	39	81	75	83	82	84	80	86	35	62	18	.....
7	.....	79	81	90	88	87	81	82	31	64	18	.....
8	.....	73	66	91	86	86	68	80	28	60	16	.....
9	.....	68	55	89	86	87	61	78	27	81	15	.....
10	.....	63	49	86	82	86	56	68	25	84	15	.....
11	36	66	44	82	84	87	61	61	24	68	16	.....
12	86	72	41	79	78	87	59	71	22	53	14	59
13	87	82	38	75	78	88	49	86	21	46	14	55
14	87	77	36	70	68	86	59	86	20	38	13	51
15	85	67	33	68	72	89	87	81	20	34	12	46
16	85	60	30	63	84	88	88	72	22	30	13	44
17	85	54	28	79	78	86	87	66	21	28	40	41
18	85	53	28	86	81	86	85	62	20	26	58	38
19	86	51	44	82	86	84	79	53	18	24	69	36
20	85	37	76	77	84	85	70	34	16	33	33	34
21	86	52	80	69	81	83	61	14	15	37	23	34
22	53	88	82	63	76	82	56	87	15	54	23	36
23	23	72	85	67	72	80	55	86	14	63	40	43
24	79	53	87	82	76	74	51	86	16	36	56	47
25	83	49	87	84	70	69	62	87	14	29	37	57
26	84	41	87	87	62	63	54	76	14	25	28	47
27	86	41	85	80	56	59	48	74	12	23	25	63
28	86	35	81	74	51	53	45	83	14	26	39	69
29	85	.....	70	63	47	55	40	67	33	29	92	54
30	86	.....	67	58	45	51	41	56	42	23	89	46
31	87	.....	87	.....	86	.....	52	49	.....	21	.....	.....
1911.												
1	.....	84	.....	47	71	48	.....	29	68	85	26	62
2	.....	87	.....	43	81	63	76	37	70	86	25	50
3	.....	87	.....	54	66	76	70	37	63	86	25	50
4	.....	87	53	40	57	82	81	32	56	86	24	49
5	.....	86	49	34	59	86	81	27	49	86	24	45
6	.....	.....	45	32	58	84	81	25	44	86	30	66
7	.....	87	43	29	68	86	81	23	69	.....	33	62
8	.....	88	39	27	67	86	.....	22	23	87	58	83
9	.....	87	36	24	88	86	76	22	75	86	37	68
10	.....	.....	37	23	87	88	78	20	68	83	30	60
11	.....	.....	33	21	85	86	82	20	85	88	29	56
12	.....	88	31	22	84	85	84	23	84	75	26	52
13	.....	85	30	20	82	87	77	31	74	70	54	65
14	.....	80	32	19	86	86	70	23	66	65	77	79
15	.....	73	30	17	86	80	74	23	76	64	81	85
16	52	13	28	17	86	80	81	68	67	59	59	86
17	50	1.9	27	48	86	71	69	67	74	64	86	86
18	46	1.0	26	48	85	74	57	51	84	53	82	86
19	42	1.2	37	49	82	80	50	.....	79	49	80	86
20	38	1.6	57	51	83	77	59	75	86	46	81	86

Daily discharge, in second-feet, of New Hamakua ditch at Nailiilihaele weir, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
21	35	5.7	39	56	86	82	48	52	85	44	84	84
22	41	43	40	9.3	85	78	47	45	87	42	85	78
23	38	40	30	5.3	85	70	52	41	.....	38	65	71
24	41	56	29	6.0	78	65	46	70	87	39	84	67
25	77	54	29	4.8	71	67	40	83	86	41	76	60
26	59	54	27	34	77	73	36	78	87	41	65	55
27	76	.....	26	39	75	75	35	62	87	34	60	52
28	87	.....	24	78	63	75	32	53	.....	32	86	54
29	81	.....	23	70	58	64	30	75	87	30	84	62
30	66	.....	24	69	56	62	29	83	.....	28	73	56
31	82	.....	43	.....	55	.....	28	88	.....	28	.....	56

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in million gallons per 24 hours, as measured by a 17-foot Cippoletti weir. The ditch was not carrying water on the days for which discharge is not given.

Monthly discharge of New Hamakua ditch at Nailiilihaele weir, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January 1–6 and 11–31	87	23	70.5	3,780
February	89	35	66.1	3,670
March	88	28	62.7	3,860
April	91	58	78.6	4,680
May	88	45	75.6	4,650
June	91	51	80.1	4,770
July	88	40	63.1	3,880
August	89	14	69.9	4,300
September	44	12	24.8	1,480
October	86	21	47.4	2,910
November	92	12	31.2	1,860
December 1–5 and 12–30	91	34	53.4	2,550
The period	92	12	60.3	42,400
1911.				
January 16–31	87	35	56.9	1,810
February 1–5, 7–9, and 12–26	88	1.0	56.1	2,560
March 4–31	53	23	34.2	1,920
April	78	4.8	34.5	2,050
May	88	55	75.3	4,630
June	88	48	76.7	4,560
July 2–7 and 9–31	84	28	60.3	3,470
August 1–18 and 20–31	88	20	46.2	2,750
September 1–22, 24–27, and 29	87	44	75.2	4,030
October 1–6 and 8–31	88	28	60.0	3,570
November	86	24	57.6	3,430
December	86	45	66.4	4,080
The period	88	1.0	58.5	38,900

NOTE.—Estimates include only the days when the ditch was carrying water.

NEW HAMAKUA DITCH AT HALEHAKU WEIR, NEAR HUELO, MAUI.

The Maui Agricultural Co. maintains a 25-foot Cippoletti weir on the New Hamakua ditch just above the crossing of Halehaku Stream. This weir measures the total flow of the ditch before receiving water from Halehaku Stream. A clock register is used for recording the head on the weir. The records for 1910–11 have been furnished to the Geological Survey by the Maui Agricultural Co.

Discharge measurements of New Hamakua ditch at Halehaku weir, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 6	Pierce and Collins	8.5	34.8	0.852	71.8
6	.....do	8.5	34.8	.845	70.8
6	.....do	8.5	32.7	.662	46.3
6	.....do	8.5	30.6	.405	20.9

NOTE.—Gage heights obtained by measuring the head on 25-foot Cippoletti weir. Measurements made at lower end of tunnel just above the weir.

Daily discharge, in second-feet, of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	63	88	66	86	81	84	88	80	85	84	47	87
2	54	85	69	86	84	84	89	76	81	86	44	62
3	66	88	77	86	86	85	85	88	71	85	43	62
4	70	88	86	84	87	88	84	87	71	85	71	36
5	77	89	86	83	86	88	85	90	77	83	47	60
6	66	89	83	86	90	87	83	91	75	84	44	44
7	60	88	85	88	86	90	86	86	69	84	44	12
8	31	86	78	88	84	91	81	85	64	84	40	8.4
9	29	82	69	86	87	87	84	86	60	86	38	32
10	32	80	65	88	86	86	84	85	56	86	39	47
11	75	82	68	87	88	88	86	89	54	84	40	59
12	97	83	70	86	87	90	87	91	50	83	35	8.4
13	89	81	72	88	86	86	86	88	47	83	33	21
14	90	83	63	89	85	86	86	86	45	81	32	65
15	89	79	72	88	85	87	85	84	45	78	31	65
16	88	74	67	86	86	84	83	85	49	75	34	64
17	87	71	62	87	85	85	84	91	44	71	70	64
18	87	61	61	84	85	85	90	93	42	66	86	64
19	87	65	82	87	84	84	91	91	39	61	85	64
20	88	64	102	88	83	87	88	88	36	65	73	63
21	89	65	86	86	82	87	86	84	35	78	66	62
22	89	86	85	80	82	86	86	87	35	82	56	64
23	87	82	84	83	83	86	87	86	35	90	71	62
24	88	66	84	85	82	83	85	87	38	81	88	54
25	88	62	84	87	82	92	86	88	32	71	79	29
26	93	58	84	86	82	94	85	88	31	64	69	49
27	92	59	85	85	80	79	87	85	29	58	62	59
28	92	63	89	84	82	81	83	85	36	63	69	42
29	93	.....	86	84	81	82	77	87	47	63	80	84
30	95	.....	77	81	77	82	76	86	83	55	85	84
31	88	.....	83	.....	88	.....	82	86	.....	50	.....	44
1911.												
1	23	91	.....	51	86	84	59	60	97	81	46	85
2	24	86	9.4	49	90	85	83	69	97	86	45	82
3	22	84	66	60	89	85	85	65	88	86	43	85
4	24	82	84	61	88	85	84	59	88	86	41	84
5	23	83	85	65	88	86	84	52	86	83	41	73
6	19	68	83	60	88	85	86	48	87	85	50	73
7	10	85	78	61	88	84	84	46	88	78	53	82
8	9.8	85	72	47	85	85	58	44	88	86	82	84
9	9.1	78	61	45	82	86	85	44	85	85	66	86
10	17	29	63	51	84	86	85	41	84	86	54	80
11	17	53	63	50	83	87	87	42	83	80	51	84
12	25	84	59	50	85	85	85	45	83	85	44	82
13	20	84	56	45	86	84	83	66	86	85	78	83
14	15	84	61	43	88	84	83	46	90	84	86	77
15	57	82	73	41	85	87	84	44	93	83	83	86
16	56	71	71	40	83	86	89	88	89	82	83	84
17	54	68	67	72	86	85	91	87	89	83	85	82
18	67	62	56	72	87	84	90	85	87	83	84	82
19	71	50	56	69	88	85	94	88	88	84	86	82
20	75	57	74	70	87	86	94	86	84	80	86	88

Daily discharge, in second-feet, of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
21	77	52	68	78	84	84	88	89	84	76	84	90
22	75	74	71	76	87	86	87	84	84	74	82	90
23	77	69	60	71	55	84	89	78	85	69	28	89
24	80	70	59	11	86	61	84	89	84	65	46	84
25	82	63	59	1.6	83	83	80	88	86	68	89	83
26	86	44	58	4.0	81	84	77	88	87	68	87	86
27	83	27	56	4.1	86	84	72	83	85	57	87	87
28	84	.....	52	83	85	84	68	88	86	55	86	86
29	85	.....	54	77	85	84	64	86	87	53	84	86
30	82	.....	58	78	85	91	60	88	81	51	86	85
31	85	.....	51	.....	84	.....	58	83	.....	48	.....	85

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in million gallons per 24 hours. The ditch was not carrying water on Feb. 28 and Mar. 1, 1911.

Monthly discharge of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	97	29	78.0	4,800
February	89	58	76.7	4,260
March	102	61	77.7	4,780
April	89	81	85.7	5,100
May	90	77	84.3	5,180
June	94	79	86.1	5,120
July	91	76	85.0	5,230
August	93	76	86.7	5,330
September	85	29	50.9	3,030
October	90	50	75.8	4,660
November	88	31	56.7	3,370
December	87	8.4	52.3	3,220
The year	102	8.4	74.9	54,100
1911.				
January	86	9.1	49.5	3,040
February 1–27	91	27	69.1	3,700
March 2–31	85	9.4	62.8	3,740
April	83	1.6	52.9	3,150
May	90	55	84.7	5,210
June	91	61	84.3	5,020
July	94	58	80.6	4,960
August	89	41	69.3	4,260
September	97	81	87.0	5,180
October	86	48	76.0	4,670
November	89	28	68.2	4,060
December	90	73	83.7	5,150
The year [a]	97	1.6	72.4	52,100

[a] For 363 days.

OLD HAMAKUA DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

The Maui Agricultural Co. maintains a 20-foot Cippoletti weir and clock register on the Old Hamakua ditch a short distance below the crossing of Opana Stream. The discharge at this point gives the total quantity of water received by the Old Hamakua ditch east of that point. The records for 1910–11 have been furnished to the Geological Survey by the Maui Agricultural Co.

Daily discharge, in second-feet, of Old Hamakua ditch at Opana weir, near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	29	40	12	43	23	41	4.5	3.2	2.3	27	0.6	42
2	22	41	11	43	38	41	1.6	1.1	1.6	38	.5	41
3	11	36	32	43	34	41	14	32	16	43	.5	42
4	12	32	41	43	42	37	37	43	16	33	2.5	42
5	37	33	34	40	41	36	33	34	2.0	26	.8	42
6	29	32	35	35	36	33	33	33	1.6	27	.5	21
7	4.1	30	34	36	43	38	37	32	1.6	27	.5	20
8	2.7	30	32	43	40	38	33	33	1.2	27	.5	22
9	3.4	30	29	40	41	42	25	32	1.7	33	.5	33
10	22	28	25	33	37	40	18	27	1.7	41	.5	23
11	24	26	18	29	32	42	14	20	1.1	31	.5	28
12	36	30	11	26	29	40	16	29	1.1	26	.5	44
13	42	36	5.6	13	27	43	6.5	40	1.1	20	.5	43
14	42	31	4.2	21	20	40	11	42	1.4	9.9	.5	43
15	29	30	1.9	21	20	42	42	38	.6	1.6	.5	36
16	35	29	1.4	18	34	41	42	33	.8	1.4	.5	29
17	41	24	2.0	35	27	40	37	20	.6	1.2	3.9	23
18	42	31	2.2	40	28	41	34	13	.8	1.1	14	18
19	33	28	2.8	29	28	38	30	4.2	.8	1.1	21	15
20	34	14	10	26	26	38	26	30	.8	1.1	6.8	13
21	38	23	29	24	24	38	23	44	.6	1.5	3.1	10
22	40	38	36	23	23	34	14	42	1.0	10	.5	18
23	40	32	40	24	24	35	9.0	41	1.0	14	.1	9.6
24	34	32	40	26	24	33	4.9	38	1.0	3.2	21	33
25	32	28	43	28	22	8.7	12	41	.6	1.1	5.9	36
26	30	23	44	42	20	8.4	11	39	.6	1.0	1.0	31
27	34	21	40	33	16	27	2.5	32	.5	.8	1.0	36
28	33	13	35	28	7.1	14	1.7	36	.5	.6	13	40
29	31	.....	32	24	1.0	18	1.7	24	7.3	.6	42	33
30	34	.....	30	22	1.0	8.7	1.4	16	41	.6	41	25
31	40	.....	40	.....	38	.....	4.0	5.4	.....	.6	.....	31
1911.												
1	17	35	4.8	42	26	15	19	0.6	17	34	1.1	22
2	25	43	5.6	33	24	25	26	.6	14	42	1.1	16
3	14	42	14	36	23	36	29	.5	24	42	1.1	12
4	33	42	7.7	17	21	36	35	.5	23	42	1.0	11
5	35	42	2.8	4.0	21	40	33	.5	14	39	1.0	11
6	26	28	1.7	.6	26	41	37	.4	2.5	36	1.1	29
7	29	43	1.6	2.5	23	41	37	.4	23	30	1.1	16
8	22	43	2.6	14	17	40	29	.4	43	43	17	38
9	20	27	11	12	42	41	40	.4	36	39	2.0	24
10	37	.6	14	1.9	42	40	40	.4	30	35	1.1	23
11	35	31	1.9	.5	41	41	44	.3	43	33	1.1	17
12	34	34	.6	.5	28	38	41	.3	41	33	1.1	12
13	38	24	.6	.6	14	35	36	.6	34	27	12	17
14	35	25	4.6	.5	41	39	29	.5	16	23	37	35
15	29	34	1.9	.3	43	32	28	.5	18	21	39	46
16	33	15	1.1	.3	39	34	32	13	25	19	24	42
17	29	1.1	1.0	16	42	29	24	14	30	21	42	40
18	20	1.1	4.2	23	41	28	13	3.2	40	7.7	34	41
19	12	1.2	25	26	30	28	1.4	39	30	2.5	29	42
20	5.7	1.1	24	23	23	23	6.8	24	43	2.3	34	37
21	1.4	1.1	10	24	31	22	1.4	8.5	40	1.2	45	31
22	1.6	6.6	13	32	31	9.0	4.8	.6	43	1.2	43	27
23	2.2	12	5.6	34	36	24	3.1	.4	40	1.2	40	25
24	27	15	5.6	35	27	19	1.0	15	41	1.2	37	26
25	16	25	4.6	37	25	25	.6	34	41	1.2	33	2.5
26	22	12	1.0	36	25	33	.6	36	43	1.2	24	1.5
27	30	25	1.0	40	24	32	.6	28	42	1.2	19	1.4
28	41	5.9	1.0	42	23	35	.6	9.6	42	1.2	41	1.2
29	32	.....	1.9	35	23	44	.6	32	41	1.2	34	1.1
30	28	.....	5.9	31	11	18	.6	43	19	1.1	30	1.1
31	32	.....	39	.....	18	.....	.6	35	.....	1.1	.....	1.1

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in million gallons per 24 hours.

Monthly discharge of Old Hamakua ditch at Opana weir, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	42	2.7	29.6	1,820
February	41	13	29.3	1,630
March	44	1.4	24.3	1,490
April	43	13	31.0	1,840
May	43	1.0	27.3	1,680
June	43	8.4	33.9	2,020
July	42	1.4	18.7	1,150
August	44	1.1	29.0	1,780
September	41	.5	3.63	216
October	43	.6	14.6	898
November	42	.1	6.16	367
December	44	9.6	29.8	1,830
The year	44	.1	23.1	16,800
1911.				
January	41	1.4	24.6	1,510
February	43	.6	22.0	1,220
March	39	.6	7.07	435
April	42	.3	20.0	1,190
May	43	11	28.4	1,750
June	44	9.0	31.4	1,870
July	44	.6	19.2	1,180
August	43	.3	11.0	676
September	43	2.5	31.3	1,860
October	43	1.1	18.9	1,160
November	45	1.0	20.9	1,240
December	46	1.1	21.0	1,290
The year	46	.3	21.3	15,400

KALUANUI DITCH AT PUUOMALEI, NEAR HAMAKUAPOKO, MAUI.

Kaluanui ditch heads in Opana Stream at an elevation of 2,500 feet. It collects water from several small streams above Puuomalei and finally joins the New Hamakua ditch west of Maliko Gulch.

The Maui Agricultural Co. maintains a small weir on this ditch and has furnished the records for 1910–11 to the Geological Survey.

Daily discharge, in second-feet, of Kaluanui ditch at Puuomalei, near Hamakuapoko, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	2.5	2.5	4.2	5.3	5.3	6.2	7.1	4.5	7.1	6.2	2.5	6.2
2	2.5	2.5	4.2	4.8	5.3	6.2	7.1	5.4	7.1	6.2	2.5	6.2
3	2.5	2.5	4.2	4.8	5.9	6.2	7.1	7.1	7.1	6.2	2.5	6.2
4	2.5	2.5	4.2	4.8	5.9	6.2	7.1	7.1	7.1	6.2	2.5	6.2
5	2.5	2.5	4.2	4.8	5.9	6.2	7.1	7.1	7.1	6.2	2.5	6.2
6	2.5	2.5	4.2	4.8	5.9	7.1	7.1	7.1	7.1	6.2	2.5	6.2
7	2.5	2.5	4.2	4.8	5.9	7.1	7.1	7.1	7.1	6.2	2.5	6.2
8	2.5	2.8	3.6	4.8	5.9	7.1	7.1	7.1	5.4	6.2	2.5	6.2
9	2.5	3.1	3.6	4.8	5.9	7.1	7.1	6.2	4.5	6.2	2.5	6.2
10	2.5	3.3	3.6	4.8	5.9	7.1	7.1	6.2	4.5	6.2	2.5	6.2
11	2.5	3.6	3.6	4.8	5.9	7.1	7.1	6.2	4.5	6.2	2.5	6.2
12	2.5	3.4	3.6	4.8	5.9	7.1	7.1	7.1	4.0	6.2	2.5	5.4
13	2.5	3.1	4.8	4.8	5.9	7.1	6.2	7.1	4.6	6.2	2.5	5.4
14	2.5	3.1	4.8	4.8	5.9	7.1	7.1	7.1	3.1	6.2	1.9	5.4
15	2.5	3.1	4.8	4.8	5.9	7.1	7.1	7.1	3.1	6.2	1.9	5.4
16	2.5	3.1	4.8	5.3	5.9	7.1	7.1	7.1	3.1	6.2	1.9	5.4
17	2.8	3.1	4.8	5.3	5.9	7.1	7.1	7.1	3.1	6.2	2.5	5.4
18	3.1	3.2	4.8	5.3	5.9	7.1	7.1	7.1	3.1	6.2	4.5	5.4
19	3.1	3.9	4.8	5.3	5.9	7.1	7.1	7.1	3.1	6.2	6.3	5.4
20	3.1	4.2	4.8	5.3	5.9	7.1	7.1	7.1	3.1	6.2	6.3	5.4

Daily discharge, in second-feet, of Kaluanui ditch at Puuomalei, near Hamakuapoko, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
21	3.1	4.2	4.8	5.3	5.9	7.1	7.1	7.1	3.1	6.2	6.3	5.4
22	3.1	4.2	7.2	5.3	5.9	7.1	7.1	7.1	2.5	6.2	3.1	5.4
23	3.1	4.2	7.2	5.3	5.9	7.1	7.1	7.1	2.5	6.2	3.1	5.4
24	3.1	4.2	4.8	5.3	6.2	7.1	7.1	7.1	2.5	6.2	7.1	5.4
25	3.1	4.2	4.8	5.3	6.2	7.1	7.1	7.1	2.5	6.2	7.1	5.4
26	3.1	4.2	4.8	5.3	6.2	7.1	7.1	7.1	2.5	6.2	7.1	5.4
27	2.8	4.2	4.8	5.3	6.2	7.1	7.1	7.1	2.5	3.9	7.1	5.4
28	2.5	4.2	4.8	5.3	6.2	7.1	7.1	7.1	2.5	3.9	7.1	5.4
29	2.5	.....	4.8	5.3	6.2	7.1	7.1	7.1	2.5	3.9	6.2	5.4
30	2.5	.....	5.3	5.3	6.2	7.1	7.1	8.8	7.1	3.9	5.4	5.4
31	2.5	.....	5.3	.....	6.2	.....	7.1	8.8	.....	3.9	.....	5.4
1911.												
1	5.4	7.1	7.9	7.1	7.9	7.1	7.1	2.5	6.2	9.0	3.9	7.1
2	5.4	7.1	7.9	7.1	7.9	7.1	7.1	2.5	6.2	9.0	3.9	7.1
3	5.4	6.2	7.9	7.1	7.9	7.1	7.1	1.4	6.2	9.0	3.1	7.1
4	5.4	6.2	7.9	7.1	7.9	7.1	7.1	1.4	6.2	9.0	3.1	7.1
5	5.4	7.9	7.9	7.1	7.9	7.1	7.1	1.4	5.4	9.0	3.1	7.1
6	5.4	7.1	7.9	7.1	7.9	7.1	7.1	1.4	5.4	9.0	3.1	7.1
7	5.4	7.1	7.9	7.1	7.9	7.1	6.2	1.9	5.4	7.9	3.1	7.1
8	5.4	7.1	7.9	7.1	7.1	7.1	6.2	1.9	6.2	7.9	3.1	7.1
9	5.4	7.9	7.9	7.1	7.1	7.1	6.2	1.4	6.2	7.9	3.1	7.1
10	5.4	7.9	7.9	7.1	7.1	7.1	6.2	1.9	6.2	7.1	3.1	7.1
11	5.4	5.4	7.9	7.1	7.1	7.1	6.2	1.9	6.2	6.2	3.1	7.1
12	5.4	5.4	7.1	7.1	7.1	7.1	6.2	1.9	6.2	6.2	3.1	7.1
13	5.4	5.4	7.1	7.1	7.1	7.1	6.2	2.5	6.2	6.2	3.1	7.1
14	5.4	5.4	7.1	7.1	7.1	7.1	6.2	1.9	6.2	5.4	3.1	7.1
15	5.4	5.4	7.1	7.1	7.1	7.1	6.2	1.9	6.2	5.4	3.1	7.1
16	5.4	7.1	7.1	7.1	7.1	7.1	5.0	2.5	6.2	5.4	5.4	7.1
17	5.4	7.1	7.1	7.1	7.1	7.1	5.0	2.5	6.2	5.4	5.4	7.1
18	5.4	7.1	7.1	7.1	7.1	7.1	4.6	1.9	7.1	5.4	7.1	7.1
19	5.4	7.1	7.1	7.1	7.1	7.1	4.6	1.9	7.1	5.4	7.1	7.1
20	5.4	7.1	7.1	7.1	7.1	7.1	4.6	5.4	7.1	5.4	7.9	7.1
21	5.4	7.1	7.1	7.1	7.1	7.1	4.6	5.4	7.9	5.4	7.1	7.1
22	5.4	7.1	7.1	7.1	7.1	7.1	4.6	5.4	7.9	4.6	7.1	7.1
23	5.4	7.1	7.1	7.1	7.1	7.1	4.6	3.1	7.9	4.6	7.1	7.1
24	5.4	7.1	7.1	7.1	7.1	7.1	3.1	3.1	7.9	4.6	7.1	7.1
25	5.4	7.9	7.1	7.1	7.1	7.1	3.1	3.9	7.9	4.6	7.1	7.1
26	5.4	6.2	7.1	7.1	7.1	7.1	3.1	5.4	7.9	4.6	7.1	7.1
27	5.4	6.2	7.1	7.1	7.1	7.1	3.1	5.4	7.9	4.6	7.1	7.1
28	5.4	9.0	7.1	7.1	7.1	7.1	0.0	5.4	7.9	4.6	7.1	7.1
29	5.4	.....	7.1	7.1	7.1	7.1	0.0	5.4	7.9	4.6	7.1	7.1
30	5.4	.....	7.1	7.1	7.1	7.1	1.0	5.4	7.9	3.9	7.1	7.1
31	5.4	.....	7.1	.....	7.1	.....	2.5	5.4	.....	3.9	.....	7.1

NOTE.—Daily discharge in second-feet computed by the Geological Survey from weir records of daily discharge in million gallons per 24 hours.

Monthly discharge of Kaluanui ditch at Puuomalei, near Hamakuapoko, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	3.1	2.5	2.69	165
February	4.2	2.5	3.36	187
March	7.2	3.6	4.66	287
April	5.3	4.8	5.07	302
May	6.2	5.3	5.94	365
June	7.1	6.2	6.95	414
July	7.1	6.2	7.64	470
August	8.8	4.5	6.98	429
September	7.1	2.5	4.30	256
October	6.2	3.9	5.83	358
November	7.1	1.9	3.91	233
December	6.2	5.4	5.68	349
The year	8.8	1.9	5.27	3,820

Monthly discharge of Kahuanui ditch at Puuomalei, near Hamakuapoko, Maui, for 1910–11—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1911.				
January	5.4	5.4	5.40	332
February	9.0	5.4	6.85	380
March	7.9	7.1	7.38	454
April	7.1	7.1	7.10	422
May	7.9	7.1	7.28	448
June	7.1	7.1	7.10	422
July	7.1	0.0	4.90	301
August	5.4	1.4	3.07	189
September	7.9	5.4	7.04	419
October	9.0	3.9	6.17	379
November	7.9	3.1	5.06	301
December	7.1	7.1	7.10	437
The year	9.0	0.0	6.20	4,480

LOWRIE DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

The Hawaiian Commercial & Sugar Co. maintains a 16½-foot weir on the Lowrie ditch a short distance west of Halehaku Gulch and has kindly furnished the records for 1910–11 to the Geological Survey.

Discharge measurements of Lowrie ditch at Opana weir near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 11	Pierce and Collins	6.0	15.4	1.10	63.1
Dec. 6	J. B. Stewart	6.0	27.6	1.33	91.8

NOTE.—Gage heights obtained by measuring the head on a 16½-foot weir. Measurements made a short distance below the weir.

Daily discharge, in second-feet, of Lowrie ditch at Opana weir, near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1910.												
1	93	88	88	95	95	93	83	86	92	90	47	95
2	93	88	82	95	96	92	69	76	92	88	45	97
3	92	88	83	94	96	64	82	87	92	92	43	96
4	99	90	93	94	96	88	92	94	91	92	72	96
5	96	91	90	94	96	95	87	89	89	90	43	101
6	80	92	94	94	96	95	92	90	66	90	43	99
7	88	92	94	94	96	93	94	90	50	89	46	82
8	90	92	93	94	96	89	93	90	75	91	40	47
9	90	92	93	94	96	95	92	90	65	91	38	23
10	89	92	94	94	96	95	91	90	62	92	39	55
11	76	89	93	93	95	95	92	89	57	92	46	92
12	53	84	83	95	95	95	92	91	55	92	36	94
13	91	91	78	95	95	87	90	93	53	89	34	93
14	90	92	81	95	95	88	92	92	50	83	32	92
15	90	94	67	94	96	95	93	91	48	61	30	95
16	90	94	63	74	95	94	91	91	56	59	32	91
17	90	91	65	96	96	94	91	90	47	82	82	84
18	90	93	64	96	96	94	92	90	45	69	90	79
19	90	94	80	95	96	95	92	88	43	61	90	81
20	90	82	92	96	96	94	92	92	40	62	85	88
21	90	72	89	95	96	94	92	94	39	85	84	88
22	90	92	89	95	96	93	91	91	38	81	62	95
23	90	81	92	95	95	93	89	92	45	89	71	73
24	90	92	95	95	95	93	84	91	48	83	90	96
25	90	91	94	94	95	92	89	93	38	84	87	73

Daily discharge, in second-feet, of Lowrie ditch at Opana weir, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
26	90	84	73	94	94	92	85	91	40	73	88	89
27	93	85	96	94	94	92	81	63	36	57	72	81
28	93	82	94	94	86	89	78	94	42	69	82	94
29	92	.....	95	93	66	92	77	92	65	75	91	94
30	92	.....	95	92	63	85	74	92	91	60	94	92
31	89	.....	95	.....	93	.....	83	92	.....	52	.....	93
1911.												
1	93	96	93	90	87	72	81	71	82	84	44	84
2	93	96	92	80	88	83	80	85	83	85	42	81
3	92	96	92	93	87	85	81	83	83	86	40	76
4	93	96	86	85	86	85	82	77	80	86	38	83
5	93	96	86	77	86	89	81	77	81	85	39	80
6	93	100	82	74	88	87	82	61	80	85	52	85
7	94	95	77	70	88	90	80	52	82	88	40	85
8	94	96	72	64	87	89	80	53	82	87	73	88
9	64	96	70	61	93	88	81	54	82	85	65	86
10	95	96	77	57	90	92	80	49	83	84	62	85
11	95	82	50	63	87	89	82	51	83	83	51	81
12	95	66	63	62	89	89	81	57	82	84	44	79
13	95	48	57	56	91	90	79	79	82	83	66	82
14	94	50	60	49	90	89	80	59	82	84	78	82
15	94	78	91	43	89	88	82	46	83	83	79	85
16	95	88	71	46	88	88	84	72	84	81	74	84
17	95	76	73	82	88	89	82	81	83	82	79	83
18	95	71	61	77	87	90	82	78	85	80	76	83
19	91	68	73	71	87	90	82	82	85	81	74	83
20	92	71	86	83	80	90	82	79	88	78	75	82
21	86	71	77	82	89	90	82	79	89	73	69	82
22	84	80	69	83	82	91	82	78	86	72	63	82
23	87	80	60	94	83	86	83	79	89	67	24	82
24	93	83	64	89	85	85	79	82	87	61	87	95
25	94	91	67	93	85	85	73	82	85	63	88	85
26	94	93	64	93	86	87	79	80	85	58	87	86
27	94	94	73	89	86	85	78	80	85	58	86	82
28	95	95	69	88	85	86	79	79	86	54	89	76
29	95	.....	54	87	85	87	61	85	86	50	87	84
30	95	.....	30	88	85	86	28	83	99	48	87	82
31	95	.....	62	.....	85	.....	64	83	.....	47	.....	86

NOTE.—Daily discharge Jan. 1, 1910, to Aug. 31, 1911, computed by the Geological Survey from records of head on 16½-foot weir. Discharge Sept. 1 to Dec. 31, 1911, in second-feet computed by the Geological Survey from weir records of discharge in million gallons per 24 hours.

Monthly discharge of Lowrie ditch at Opana weir, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	99	53	89.0	5,470
February	94	72	88.9	4,940
March	96	64	86.4	5,310
April	96	74	93.7	5,580
May	96	63	93.1	5,720
June	95	64	91.5	5,440
July	94	69	87.6	5,390
August	94	63	89.5	5,500
September	92	36	58.3	3,470
October	92	52	79.5	4,890
November	94	30	61.1	3,640
December	101	23	85.4	5,250
The year	101	23	83.7	60,600

Monthly discharge of Lowrie ditch at Opana, near Huelo, Maui, for 1910–11—Contd.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1911.				
January	95	64	92.2	5,670
February	100	48	83.9	4,660
March	93	30	71.0	4,370
April	94	43	75.6	4,500
May	93	80	86.8	5,340
June	92	72	87.3	5,190
July	84	28	77.8	4,780
August	85	46	72.1	4,430
September	99	80	84.4	5,020
October	88	47	75.0	4,610
November	89	24	65.3	3,890
December	95	76	83.2	5,120
The year	100	24	79.5	57,600

HAIKU DITCH AT PEAHI WEIR, NEAR HUELO, MAUI.

The Hawaiian Commercial & Sugar Co. maintains a 16½-foot weir on the Haiku ditch a short distance west of Halehaku Gulch and has furnished the records for 1910–11 to the Geological Survey.

Discharge measurements of Haiku ditch at Peahi weir, near Huelo, Maui, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 11	Pierce and Collins	9.7	13.9	0.62	29.4
Dec. 6	J. B. Stewart	12.2	59.9	1.32	82.0

NOTE.—Gage height obtained by measuring the head on a 16½-foot weir. Measurements made a short distance below the weir.

Daily discharge, in second feet, of Haiku ditch at Peahi weir, near Huelo, Maui, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	41	82	40	85	56	84	53	18	73	84	5	87
2	22	82	32	85	81	77	47	8	61	82	5	87
3	11	80	71	85	83	74	49	60	69	85	4	86
4	39	84	82	85	84	76	81	87	49	84	39	86
5	74	84	81	85	84	84	84	86	55	79	6	86
6	80	82	81	85	84	83	84	85	53	82	5	82
7	80	82	81	85	84	85	84	85	41	76	5	61
8	79	77	81	84	85	85	84	85	11	85	5	67
9	77	57	62	85	85	85	84	85	8	85	4	74
10	77	50	39	82	85	84	53	84	6	83	4	48
11	80	55	40	85	85	85	77	76	3	81	4	70
12	82	59	43	85	84	85	77	83	2	68	3	75
13	82	60	42	72	81	85	65	86	1	71	3	64
14	82	70	43	53	61	85	70	85	.8	65	3	20
15	82	85	37	52	61	85	84	85	.4	57	2	20
16	82	55	20	54	90	85	84	85	.4	28	2	15
17	82	51	5	60	85	84	84	70	0	24	19	11
18	81	71	5	83	83	85	84	56	0	6	73	11
19	78	39	27	82	85	85	84	50	0	5	82	12
20	80	16	82	83	85	85	84	82	0	5	51	12
21	80	26	83	81	85	84	67	86	0	48	23	11
22	79	81	83	56	71	83	66	86	0	50	6	16
23	81	79	83	58	62	83	75	87	0	80	28	11
24	81	68	83	56	80	85	66	86	.8	49	76	75
25	77	39	83	82	58	86	75	85	1	20	64	82

Daily discharge, in second-feet, of Haiku ditch at Peahi weir, near Huelo, Maui, for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
26	80	25	83	82	54	62	58	84	1	9	19	82
27	81	18	83	82	46	72	58	85	.8	10	8	85
28	71	37	83	81	40	64	22	85	6	16	27	85
29	76	.....	83	57	32	77	8	85	15	9	86	66
30	82	.....	84	51	19	58	8	85	79	7	86	49
31	82	.....	81	.....	72	.....	22	75	.....	6	.....	79
1911.												
1	85	86	85	58	76	46	74	20	77	73	5	60
2	84	85	85	41	75	76	76	27	76	76	4	73
3	85	85	72	71	72	72	76	4	78	81	3	60
4	85	85	40	34	54	76	76	3	75	81	3	53
5	71	85	40	25	50	76	76	2	61	81	3	35
6	88	91	31	15	74	76	76	.2	58	81	4	66
7	87	85	13	13	73	76	76	.1	74	82	3	65
8	89	85	21	11	71	75	76	.1	80	82	37	84
9	86	85	31	13	78	75	76	.1	79	82	33	81
10	86	86	36	28	76	76	76	.0	77	82	7	79
11	84	85	27	25	76	76	76	.6	77	82	4	77
12	90	86	32	22	76	76	40	1	78	82	3	54
13	86	86	43	20	76	76	76	22	79	73	53	79
14	85	86	46	17	77	76	76	2	79	69	77	73
15	84	86	53	7	74	76	76	2	79	59	83	83
16	71	55	31	21	76	76	77	46	79	66	76	83
17	82	35	22	63	76	76	75	73	79	77	81	83
18	73	33	36	59	76	76	66	49	79	42	82	83
19	39	25	26	64	75	76	71	74	79	12	82	83
20	9	17	46	70	77	76	70	74	81	8	82	83
21	13	13	6	77	78	76	59	49	79	7	82	83
22	13	15	9	72	76	76	57	43	80	6	82	83
23	14	15	5	77	76	76	68	31	82	6	82	75
24	71	28	3	76	76	73	55	58	84	6	82	81
25	76	25	3	76	76	77	33	71	83	6	82	83
26	20	21	3	76	76	76	6	75	82	6	82	70
27	87	49	30	76	77	75	15	75	82	6	74	47
28	87	79	37	75	76	76	5	61	83	6	82	47
29	86	.....	35	76	72	76	5	71	83	5	79	58
30	53	.....	20	76	69	70	33	77	85	5	79	45
31	86	.....	54	.....	60	.....	17	77	.....	5	.....	56

NOTE.—Daily discharge Jan. 1, 1910, to Aug. 31, 1911, computed by the Geological Survey from records of head on 16⅔-foot weir. Daily discharge Sept. 1 to Dec. 31, 1911, computed by the Geological Survey from weir records of discharge in million gallons per 24 hours.

Monthly discharge of Haiku ditch at Peahi weir, near Huelo, Maui, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	82	11	73.3	4,510
February	85	16	60.5	3,360
March	84	5	61.5	3,780
April	85	51	74.7	4,440
May	90	19	71.9	4,420
June	86	58	80.7	4,800
July	84	8	65.2	4,010
August	87	8	76.5	4,700
September	79	0	17.9	1,070
October	85	5	49.6	3,050
November	86	2	24.9	1,480
December	87	11	54.8	3,370
The year	90	0	59.4	43,000

Monthly discharge of Haiku ditch at Peahi weir, near Huelo, Maui, for 1910–11—Contd.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1911.				
January	90	9	69.5	4,270
February	91	15	60.6	3,370
March	85	3	32.9	2,020
April	77	7	47.8	2,840
May	78	50	73.2	4,500
June	76	46	74.5	4,430
July	77	5	58.5	3,600
August	77	0	35.1	2,160
September	85	58	78.2	4,650
October	82	5	46.3	2,850
November	83	3	51.0	3,030
December	84	35	69.8	4,290
The year	91	0	58.0	42,000

MISCELLANEOUS MEASUREMENTS ON EAST MAUI.

The following miscellaneous measurements of streams, ditches, and pumping plants on East Maui were made during 1911. The measurements of streams and ditches are arranged in order from east to west.

Miscellaneous measurements of streams on East Maui in 1911.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
Jan. 18	Nailiilihaele	Kailua Stream	Just below intake of old Hamakua ditch, near Huelo, Maui.	9.2
25	do	do	do	18.8
18	Nailiilihaelelilili	Nailiilihaele Stream	Just above intake of old Hamakua ditch, near Huelo, Maui.	5.8
25	do	do	do	9.7

Miscellaneous measurements of ditches on East Maui in 1911.

Date.	Ditch.	Diversion from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Nov. 19	Koolau	Various streams	1,000 feet below Nahiku Weir, near Nahiku, Maui.	.....	36.6
Dec. 16	do	do	do	[a] 1.16	37.9
Nov. 2	Spreckels	do	125 feet below Oopuola Stream, near Huelo, Maui.	[b] 3.53	31.2
Sept. 6	Lowrie	do	12 feet above crest of weir near Hamakuapoko, Maui.	[c] 1.24	89.0
Apr. 10	do	do	Just below weir near Hamakuapoko, Maui.	[d] .97	51.0
Sept. 5	do	do	do	[d] 1.25	74.0
Apr. 10	do	do	Between fields 77 and 80, near Keahua, Maui.	.....	[g] 49.3
Sept. 6	do	do	do	.....	68.0
6	Diversion [e]	Lowrie ditch	Weir near Hamakuapoko	.....	8.5
Apr. 10	Haiku	Various streams	Above weir near Hamakuapoko, Maui.	[f] .93	47.9

[a] Distance from top of right cement wall to water surface in channel of approach, 11.2 feet back of weir crest.
[b] Distance to water surface from tack on left bank, 125 feet below Oopuola stream.
[c] Head over 10-panel division weir. Nine panels only were delivering water.
[d] Head over 10-panel division weir; measurement represents discharge over 9 panels only.
[e] This ditch carries the flow of one panel of the 10-panel division weir.
[f] Head on weir.
[g] Loss of 1.7 second feet by seepage between Hamakuapodo weir and this point.

Miscellaneous measurements of pumping plants on East Maui in 1911.

Date.	Pump.	Locality.	Discharge.
			Sec.-ft.
Sept. 4	Riedler No. 1	Station No. 1 near Paia	6.9
4	do	do	6.9
4	Riedler No. 2	do	6.7
6	Blake duplex No. 4	do	7.5
5	Riedler No. 1	Station No. 2 in Maliko Gulch, near Hamakuapoko.	6.5
5	Riedler No. 2	do	4.6
11	Riedler	Station No. 1, near Puunene	12.8
13	Roots rotary	Station No. 2, near Puunene	5.3
13	Risdon	Station No. 3, near Puunene	9.2
9	Riedler	Station No. 4, near Puunene	12.0
11	Riedler "A"	Station No. 5, near Puunene	20.5
11	Riedler "B"	do	18.3
12	Worthington "A"	Station No. 1 K, near Kihei	8.1
12	Riedler	Station No. 3 K, near Kihei	12.6

PUMPED WATER ON EAST MAUI.

Considerable water is pumped for irrigation on the west end of East Maui and on the isthmus connecting East and West Maui. About 15 pumping stations have been established by the Hawaiian Commercial & Sugar Co. and the Maui Agricultural Co. These pumping stations are only run during parts of the year when there is a shortage in the gravity supply delivered by the ditches. These companies have kindly furnished records of the amount of water pumped monthly, as indicated by pump displacement, to the Geological Survey.

Monthly summary of water pumped by the Maui Agricultural Co. at Paia, Maui, for 1910–11.

Month.	Mean quantity pumped daily.		Total quantity pumped.	
	Million gallons.	Second-feet.	Million gallons.	Acre-feet.
1910.				
January	0.0	0.0	0.0	0.0
February	.0	.0	.0	.0
March	.30	.46	9.3	28.6
April	.0	.0	.0	.0
May	.0	.0	.0	.0
June	.0	.0	.0	.0
July	3.12	4.83	96.9	297
August	3.21	4.97	99.5	305
September	20.4	31.6	613	1,880
October	11.0	17.0	340	1,040
November	10.3	16.0	310	951
December	.0	.0	.0	.0
The year	.....	.....	1,470	4,500
1911.				
January	.0	.0	.0	.0
February	.0	.0	.0	.0
March	.0	.0	.0	.0
April	.68	1.06	20.3	62.4
May	.0	.0	.0	.0
June	.0	.0	.0	.0
July	8.35	12.9	259	795
August	20.1	31.2	624	1,920
September	10.4	16.1	312	957
October	6.32	9.79	196	602
November	4.83	7.48	145	445
December	.0	.0	.0	.0
The year	.....	.....	1,560	4,780

NOTE.—The above summary has been compiled by the Geological Survey from records furnished by the Maui Agricultural Co. It represents the amount of underground water raised by six pumps, four of which are located at Paia and two in Maliko Gulch, near Haiku. The measurements were obtained by means of pump displacement.

Monthly summary of water pumped by the Hawaiian Commercial & Sugar Co. at Puunene, Maui, for 1910–11.

Month.	Mean quantity pumped daily.		Total quantity pumped.	
	Million gallons.	Second-feet.	Million gallons.	Acre-feet.
1910.				
January	0.46	0.71	14.2	43.6
February	.00	.00	.0	.0
March	4.48	6.95	139	427
April	.00	.00	.0	.0
May	6.42	9.94	199	611
June	7.07	10.9	212	651
July	39.0	60.0	1,210	3,710
August	43.5	67.4	1,350	4,140
September	70.3	109	2,110	6,480
October	65.5	101	2,030	6,230
November	64.3	99.5	1,930	5,920
December	.00	.00	.0	.0
The year			9,190	28,200
1911.				
January	.00	.00	.0	.0
February	.00	.00	.0	.0
March	1.14	1.77	35.4	109
April	3.77	5.83	113	347
May	2.66	4.12	82.4	253
June	8.60	13.3	258	792
July	41.0	63.5	1,270	3,900
August	75.2	116	2,330	7,150
September	60.0	93.0	1,800	5,520
October	54.5	84.4	1,690	5,190
November	50.0	77.5	1,500	4,600
December	.00	.00	.0	.0
The year			9,080	27,900

NOTE.—The above summary has been compiled by the Geological Survey from records furnished by the Hawaiian Commercial & Sugar Co. It represents the amount of underground water raised by 11 steam pumps, several of which were only working for short periods. The measurements were obtained by means of pump displacement.

ISLAND OF HAWAII.

GENERAL FEATURES.

The island of Hawaii is situated at the southeastern end of the group. It is separated from Maui on the northwest by Alenuihaha Channel, 26 miles wide. Keahole Point, the westernmost part of Hawaii, is about 70 miles due south from Hana at the east end of Maui. Mahukona on the northwest is the landing nearest Honolulu, and distant 134 miles. Hilo, the largest town and principal port, is 206 miles from Honolulu by the nearest sailing route. (See Pl. XV, at end of volume.)

In shape Hawaii is approximately triangular, the vertices being at the north, east, and south. The western side is about 90 miles long, the northeastern about 85 miles, and the southeastern about 75 miles. The total area of the island is 4,015 square miles. This is more than twice the combined area of Maui, Oahu, and Kauai, and is 62.7 per cent of the total area of the group. The island is somewhat smaller than Connecticut and considerably larger than Porto Rico.

Hawaii Island has been formed by the coalescence of four large volcanoes, namely, Kohala, Mauna Kea, Hualalai, and Mauna Loa. The first three are extinct, but Mauna Loa has two active craters, Mokuaweoweo at the summit and Kilauea on the side. These four mountains are situated at the corners of a parallelogram, the sides of which are about 25 miles.

The Kohala Mountains, at the northern angle of the parallelogram, were the first formed. They are probably as old as West Maui and doubtless formed an island of about the same size. The northeastern base originally extended several miles farther out to sea, as indicated by the cliffs along the northern coast which are 800 to 1,000 feet high and appear to have been caused by marine erosion almost entirely. This coast is also deeply dissected by canyons, one of which, Waipio, extends southward 4 or 5 miles into the mountain, thence westward several miles farther toward the summit. Waimanu is another large but short canyon, which has almost cut through into Waipio behind it. Other important gulches or canyons farther west are Awini, Honokane, and Pololu, the largest of which is Honokane. Horse trails extend westward to Waimanu and eastward to Awini. Between these two canyons the northern coast of Kohola is impassable. The summit of the mountain appears to consist of a group of cinder cones and is 5,490 feet above the sea.

The rainfall is exceedingly heavy on the northeastern slope, 363 inches being recorded in the upper Waipio Valley at elevation 4,080 feet during 1911. The amount diminishes toward the north and west to 200 inches at Honokane and 45 or 50 inches on the extreme north near Mahukona. On the leeward side the region is semiarid below elevation 1,500 feet. At higher elevations there are occasional rains but the water quickly disappears.

Waipio River is the largest stream in this part of the island. It has been partly developed for irrigation by the Hawaiian Irrigation Co. Farther north Awini, Honokane, and Pololu streams furnish the supply for the Kohala ditch. This ditch carries the water west to the cane lands of Kohala. Between Waipio and Awini there are numerous gulches carrying water, the largest being Waimanu, with a low-water flow of about 50 second-feet. Niulii and a few other short streams appear to the west of Pololu. These are all small and are diverted by the plantations for irrigation. To the west and south of Kohala there are no running streams, the storm waters running off so quickly that for the greater part of the year the gulches are dry.

Mauna Kea (white mountain) is the second oldest mountain on the island. It is at the east corner of the parallelogram formed by the four mountain masses and is only about 18 miles from the northeast coast. In order of extinction it is probably next after Haleakala, on East Maui, but, unlike Haleakala, it has no crater on the summit.

Its highest point is 13,825 feet above sea level, making it not only the highest mountain in Hawaii but the highest island mountain in the world. The northeastern base probably extended several miles farther seaward at one time, as indicated by the cliffs, which are high and precipitous. On the eastern slope are numerous gulches, some of which, such as Hakalau, Maulua, and Laupahoehoe, are large, but none of which extend back very far from the sea. The upper (windward) side (north and east) of the mountain has been affected but little by erosion, and the lee side exhibits little evidence of weathering.

The region of greatest rainfall is on the eastern slope and at elevation from 2,000 to 2,500 feet. The available records for that elevation indicate a rainfall of about 300 inches a year. A large number of streams rise in the forest on the eastern slope below 6,000 feet elevation. Wailuku River (Pl. IX, *A*), on the south, is the largest, with Honolii (Pl. IX, *B*) next in size. Waipahoehoe, Hanawai, Kawainui, and other streams to the number of 60 enter the sea between Hilo and Laupahoehoe. Some of the largest gulches, like Kolekole and Maulua, have but a small surface flow near the sea, much of the water disappearing in the coarse alluvial deposits. From Laupahoehoe northward the streams are intermittent, most of them being dry for the greater part of the year.

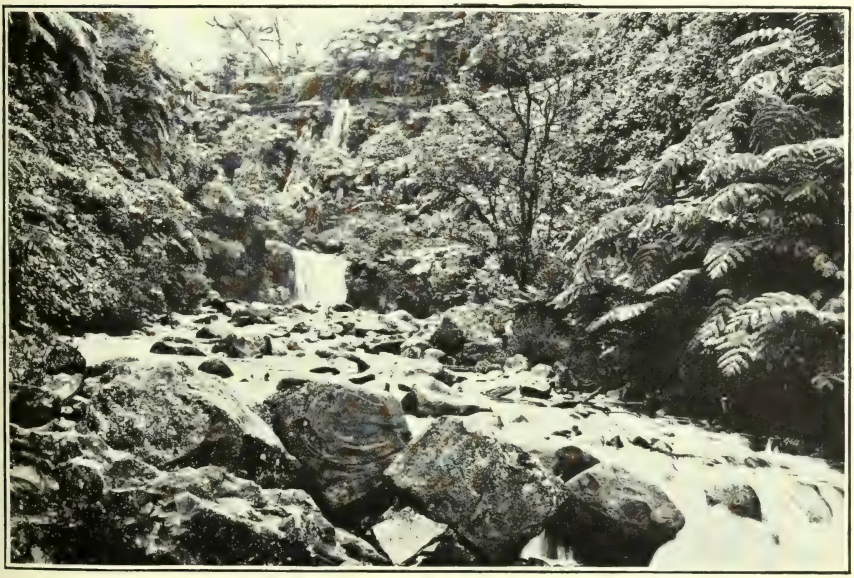
Hualalai, at the west corner of the parallelogram of mountains, is much younger than Mauna Kea; it is also much smaller. Its slopes, unbroken by cliffs or gulches, are gentle near the sea but steep higher up. Lava last flowed from this mountain in 1801 on the northwest side. There is no crater on the summit.

The rainfall is light on the slopes of Hualalai, as the moisture-laden trade winds are shut off by Mauna Kea on the northeast. The available records show an amount varying from 25 to 60 inches a year. There are no running streams on this side of the island.

Mauna Loa (great or long mountain) is slightly south of the center of the island and embraces with its slopes the entire southern half of Hawaii. The summit platform, comprising several square miles, lies at an altitude of 13,675 feet and surrounds the crater of Mokuaweoweo. The crater is 3.7 miles long, 1.74 miles wide, 9.5 miles in circumference, and 3.70 square miles in area. The lava lake in the lower part of the crater is active only at times, its activity always preceding an outburst from the side of the mountain. Nine lava flows from the flanks of Mauna Loa have occurred during the last 100 years.

Kilauea, the largest active crater in the world, is on the southeastern slope of Mauna Loa. It is a huge pit, 2.93 miles long, 1.95 miles wide, 7.85 miles in circumference, and 4.14 square miles in area. The outer rim of the crater reaches an altitude of 3,970 feet

A. WAILUKU RIVER AT 2,500 FEET ELEVATION NEAR HILO, HAWAII.



B. HONOLII RIVER AT KAIWIKI, NEAR HILO, HAWAII.

TYPICAL MOUNTAIN STREAMS.

on the north side, dropping to 3,500 feet on the floor of the crater below. On the southwest the side walls are broken away, giving east access to the flow of the crater and the pit of Halemaumau, or lake of fire. Here one may stand on the edge of the pit and see the molten lava boiling and spouting at a distance of from 100 to 300 feet below. The level of the lake varies according to its activity, at times rising nearly to the rim. At ordinary stages it is about 500 feet long by 300 feet wide.

Kilauea is a volcano of the cauldron type and has never been known to have an explosive eruption.

The formation of this part of the island is still too recent for many geologic changes to have taken place. Many of the lava flows still remain black and barren wastes. (See Pl. VIII, *B*.) At other places where there has been sufficient rainfall the lava has been disintegrated and a luxuriant vegetation has sprung up. There are no surface streams on this part of Hawaii, as, owing to the extremely open and porous nature of the surface covering, the water immediately disappears. Numerous springs appear at low elevations along the south coast, some of the largest being at Punaluu. The Punaluu Springs appear at the edge of the sea and are submerged at high tide. The flow of these springs is about 30 or 40 second-feet.

At Kapoho, on the east point of the island, warm water flows from seams in the rocks. These "warm springs" flow into a pool about 100 feet long, 25 feet wide, and 20 feet deep. The pool is entirely surrounded by rocks and its color varies in shade from a beautiful blue to violet. As sea water mingles with the water from the springs, the pool is brackish.

Waiapele, or Green Lake, is a body of fresh water in the pit of an old crater near Kapoho. The lake covers an area of about 5 acres and is fed by springs below the surface. The dull green color of the lake is probably due to reflection from the sides of the pit, which are covered with guava bushes and pahala and coconut trees. A pumping plant takes water from this lake for domestic uses and for irrigation.

At several places along the coast springs appear below the surface of the sea, and from some of these drinking water can be obtained.

As the only surface streams on the island of Hawaii are found along the northeast coast between Hilo and Kohala in the districts of North and South Hilo, Hamakua, and North Kohala, they have been considered in three groups, namely, the Hilo group, the Hamakua group, and the Kohala group.

The streams are considered in order from southeast to northwest.

HILO GROUP OF STREAMS.

GENERAL FEATURES.

The Hilo group of streams drains the eastern slope of Mauna Kea from Hilo north to Laupahoehoe and is included in the two political districts of North Hilo and South Hilo. Along the coast there is a belt of cane from 2 to 4 miles wide, the upper level being 1,200 to 2,000 feet above the sea. Back of the cane belt there is a thick, heavy forest of ohia lehua and koa (*Acacia koa*), and a dense undergrowth of many species of fern, ieie, and various kinds of trees and plants. This jungle is practically impenetrable until a trail has been cut through and then can be traversed only on foot. The forest is heaviest and thickest at 2,000 to 2,500 feet elevation, and gradually thins above that to the upper edge at 6,000 or 7,000 feet above the sea, where it disappears. Above the forest there are grazing lands and sheep ranches reaching to 8,000 or 9,000 feet elevation, beyond which there is little vegetation.

The rainfall is heaviest in the forest at 2,000 to 2,500 feet elevation, where it probably averages 300 inches a year, although in places at lower elevations it may exceed this amount, 360 inches being recorded at elevation 1,200 feet above Hakalau in 1911.

Numerous streams rise in the forest, many of them at the lower elevations. The largest stream is Wailuku River on the south, and that probably is not more than 20 miles long. A number of the streams which appear along the public road near the shore do not reach beyond the cane belt. Near the sea, the larger streams flow in deep gulches, some of which extend far back into the forest. None of the streams, however, appear above the forest belt except intermittently.

In general the slope of the country is steep, but it flattens out in places into level areas which in the forest are swampy and saturated with water. Little is known of the topography above the cane belt. At the lower elevations the ground is broken and uneven and cut up by numerous gulches.

Measurements have been made on all the streams along the line of the public road, and regular gaging stations established on the Wailuku, Honolii, and Kawainui rivers. During the latter part of 1911 gages were established and measurements made at an elevation of about 2,500 feet at 87 stations on the streams between and including Wailuku and Kawainui rivers.

Various miscellaneous measurements were made at other points.

WAILUKU RIVER BASIN.

GENERAL FEATURES.

Wailuku River, the most southerly stream in this group, is the largest stream on the island and also the largest in the Territory. It rises on the southeastern slope of Mauna Kea, in the upper edge of the forest, and flows eastward to the sea at Hilo. Numerous tributaries enter the main stream, all from the north; at elevation 2,500 feet the Wailuku has 48 different branches, many of them small at ordinary stages. The Kapehu and the Awehi, the two principal tributaries, join the main stream some distance below the forest line. The channels are all exceedingly rough and broken, especially that of the main stream on the south (Pl. IX, *A*), which probably originated in a lava tube. It is just north of the lava flow of 1855 which reached almost to Hilo and filled several stream channels formerly existing. Wainuenue, or Rainbow Falls, near Hilo is but one of several large waterfalls on the stream. Water is diverted at about 1,000 feet elevation for fluming, and at 350 feet elevation for an electric power plant.

A gaging station is maintained on the river below all tributaries.

WAILUKU RIVER NEAR HILO, HAWAII.

A gaging station was established on Wailuku River about one-fourth mile above Rainbow Falls and 2 miles from Hilo, March 21, 1911. The station is a short distance above the intake of the power canal of the Hilo Electric Light Co., which takes out on the north side. This diversion is made directly from the stream channel without the use of a diversion dam other than the natural rocks of the stream bed, except that at times of extreme low water a temporary dam of sand bags may be constructed. At such times water may be set back far enough to affect the gage heights at the station. With this exception the conditions at the station are good.

A staff gage, graduated to tenths of a foot from 4 to 17 feet, is fastened to rocks on the south bank and is used to obtain gage heights. This gage was read twice daily until June 21. At that time a Gurley automatic water-stage register was installed and used to obtain gage heights during the remainder of the year.

Measurements are made from a cable 120 feet below the gage. The width of the stream at the measuring section is about 50 feet at low water and 125 feet at the highest stage. The total range of stage is probably as much as 18 feet.

The discharge at this station gives the total flow of the stream below all tributaries and above all diversions except for comparatively small quantities diverted above for fluming cane.

Discharge measurements of Wailuku River near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 5	C. H. Pierce	60.5	310	7.28	498
9	do	60.5	298	7.10	448
18	H. R. Schulz	56	219	5.82	188
19	do	55.5	208	5.65	167
20	do	56	213	5.75	178
22	do	56	203	5.50	157
25	do	51	179	5.10	108
Aug. 7	C. H. Pierce	51.5	143	4.53	53
8	do	51	145	4.43	50
12	do	51	142	4.35	44
14	do	51	146	4.37	46
Nov. 18	do	58	266	6.60	320
20	do	64	349	7.90	702
23	do	84	691	12.5	3,540
27	do	63	319	7.34	536
29	do	60	281	6.65	352

NOTE.—All measurements made from cable at regular section.

Daily gage height, in feet, of Wailuku River near Hilo, Hawaii, for 1911.

[Manuel De Mello and H. C. Cressman, observers.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	7.70	9.65	6.55	6.65	4.75	7.61	10.26	4.85	5.88
2	.....	6.70	8.60	6.30	6.84	4.72	6.97	9.97	4.78	5.65
3	.....	8.20	8.45	6.34	7.52	4.70	6.57	9.68	4.98	5.52
4	.....	6.81	7.60	7.90	7.44	4.65	7.17	9.39	5.23	5.45
5	.....	6.47	7.40	9.15	7.37	4.58	6.52	9.10	5.53	5.38
6	.....	7.30	7.32	8.10	6.79	4.50	6.26	8.81	5.83	5.26
7	.....	6.60	7.10	10.10	6.79	4.52	6.38	8.52	6.13	5.54
8	.....	6.40	6.45	10.55	6.75	4.42	7.09	8.23	6.44	5.88
9	.....	6.35	7.45	9.80	6.95	4.40	6.83	7.94	6.68	5.77
10	.....	5.96	8.20	8.65	6.74	4.38	6.39	7.65	6.68	5.67
11	.....	5.80	8.90	7.95	6.54	4.28	11.40	7.36	6.67	5.56
12	.....	5.77	8.80	7.32	6.43	4.34	9.24	7.07	6.66	6.55
13	.....	5.75	7.90	6.95	6.23	4.44	7.66	6.78	6.65	7.82
14	.....	5.50	7.65	6.85	6.05	4.35	7.42	6.49	6.64	8.40
15	.....	5.32	7.70	6.75	6.54	4.35	7.98	6.80	6.63	8.40
16	.....	5.25	9.35	6.55	6.67	4.40	7.51	6.49	6.62	8.40
17	.....	7.40	10.15	6.48	6.06	4.86	7.09	6.57	6.61	8.40
18	.....	7.35	8.95	6.38	5.82	4.75	8.15	6.18	6.60	8.24
19	.....	7.50	8.55	6.52	5.65	7.58	7.14	5.98	7.35	8.08
20	.....	6.65	8.37	6.41	5.75	6.66	6.74	5.73	8.10	7.92
21	6.10	6.72	8.15	6.38	5.62	5.69	6.44	5.65	8.85	7.76
22	5.91	12.30	9.25	6.54	5.50	5.34	7.03	5.56	9.60	7.60
23	6.02	14.05	8.35	6.23	5.36	5.22	9.00	5.48	10.35	6.70
24	5.90	10.05	7.85	6.05	5.23	5.44	9.62	5.39	11.10	6.46
25	5.55	13.15	7.35	6.10	5.10	6.24	8.78	5.31	10.83	7.44
26	7.45	11.15	6.90	6.60	5.05	5.82	8.38	5.22	7.85	6.80
27	9.15	9.80	6.65	6.43	5.00	5.48	8.36	5.14	7.35	6.46
28	7.25	9.70	6.47	6.13	4.95	5.68	9.54	5.05	6.93	7.01
29	6.55	8.90	6.80	6.05	4.90	8.48	8.96	4.97	6.64	7.41
30	6.35	8.10	6.85	6.28	4.85	14.23	10.03	4.94	6.28	6.74
31	6.60	.....	6.60	.....	4.80	9.09	.....	4.90	.....	6.78

NOTE.—From Mar. 21 to June 21 a staff gage was read morning and evening. After June 21 a Gurley automatic water-stage register was used. Gage heights were interpolated as follows: July 26 to Aug. 2; Oct. 2 to 13; Nov. 5 to 7, 10 to 17, and 19 to 24; Dec. 18 to 21 and 23 to 31.

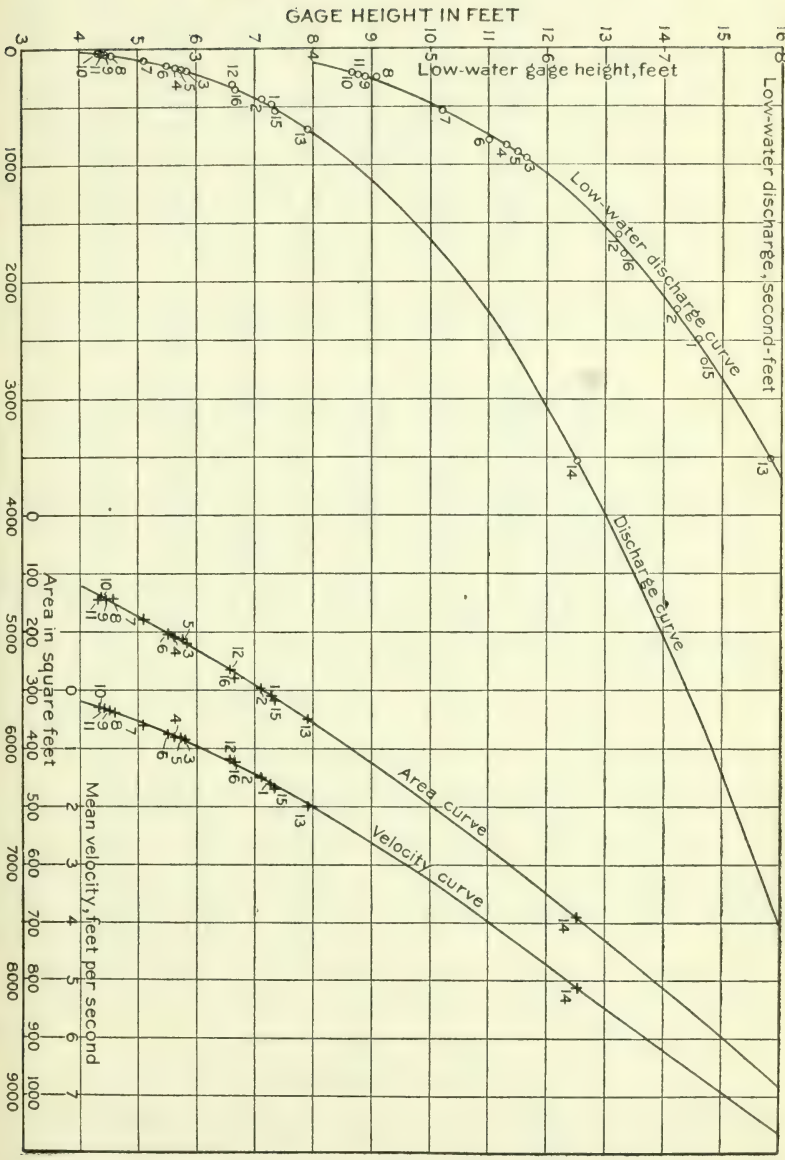


FIGURE 3.—Discharge, area, and mean velocity curves for Wailuku River near Hilo, Hawaii.

Daily discharge, in second-feet, of Wailuku River near Hilo, Hawaii, for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	633	1,460	318	340	75	603	1,810	84	200
2	.....	351	969	269	384	72	416	1,630	77	170
3	.....	811	908	276	574	70	323	1,480	96	154
4	.....	376	600	702	550	66	470	1,330	122	146
5	.....	302	537	1,210	528	61	312	1,190	156	139
6	.....	507	513	774	372	55	262	1,050	193	126
7	.....	329	450	1,710	372	56	284	936	239	157
8	.....	288	298	1,980	362	49	447	823	296	200
9	.....	279	552	1,540	410	48	381	716	346	185
10	.....	212	811	990	360	47	286	616	346	172
11	.....	189	1,090	720	316	41	2,600	525	344	159
12	.....	185	1,050	513	294	44	1,260	442	342	318
13	.....	182	702	410	256	51	620	369	340	674
14	.....	152	616	386	226	45	543	306	338	888
15	.....	132	633	362	316	45	731	374	336	888
16	.....	125	1,310	318	344	48	571	306	333	888
17	.....	537	1,740	304	228	84	447	323	331	888
18	.....	522	1,120	285	192	75	792	248	329	826
19	.....	568	948	312	170	594	461	215	522	767
20	.....	340	876	290	182	342	361	180	774	709
21	234	355	792	285	166	175	296	170	1,070	653
22	205	3,350	1,260	316	152	134	432	159	1,440	600
23	221	5,100	869	256	137	121	1,140	150	1,860	350
24	203	1,680	684	226	122	145	1,450	140	2,360	300
25	158	4,150	522	234	108	258	1,040	131	2,160	550
26	552	2,400	398	329	103	192	880	121	685	375
27	1,210	1,540	340	294	98	150	873	112	522	300
28	492	1,490	302	239	93	174	1,410	103	405	425
29	318	1,090	374	226	88	920	1,120	95	338	540
30	279	774	386	265	84	5,310	1,670	92	265	360
31	329	.....	329	.....	79	1,180	.....	88	.....	370

NOTE.—Daily discharge computed from a rating curve that is well defined below 4,000 second-feet.

Monthly discharge of Wailuku River near Hilo, Hawaii, for Mar. 21–Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 21–31	1,210	158	382	8,330	A.
April	5,100	125	965	57,400	A.
May	1,740	298	756	46,500	A.
June	1,980	226	545	32,400	A.
July	574	79	258	15,900	A.
August	5,310	41	346	21,300	A.
September	2,600	262	749	44,600	A.
October	1,800	88	524	32,200	C.
November	2,350	77	568	33,800	D.
December	888	126	435	26,700	D.
The period	.....	.....	.....	319,000	

HONOLII RIVER BASIN.

GENERAL FEATURES.

Honolii River is the second largest stream in the Hilo group. The upper end of the basin joins that of the Wailuku River on the southeastern slope of Mauna Kea without any perceptible divide between the two. At elevation about 1,500 feet a large tributary called the Pohakupaa joins Honolii River from the north. Farther down, and just before it enters the sea, the Honolii receives two large tributaries from the south, the Kikola and the Maili. The Kikola is short, and

does not reach back into the forest; the Maili is much larger than the Kikola and, as it has a well-defined gulch quite independent of the Honolii, it is not generally considered as a part of the Honolii drainage basin. Several other smaller streams enter the sea between the Honolii and Wailuku basins.

There are several small diversions from Honolii River, the water being used for domestic purposes on the plantations, and for fluming cane. The highest and perhaps largest diversion is from the north fork or Pohakupaa Stream, far inside the forest line.

The Honolii is one of the deep gulches and extends far back into the forest (Pl. IX, *B*). Near the sea, where it is crossed by the railroad and the public highway, it is one of the most picturesque spots along the coast.

A gaging station has been established on the main stream at about 1,425 feet elevation.

HONOLII RIVER AT KAIWIKI, NEAR HILO, HAWAII.

A gaging station was established on Honolii River at elevation about 1,425 feet, June 1, 1911. The station is a short distance below the confluence of the Pohakupaa with the south branch or main Honolii stream. This point is well inside the forest line, although the Kaiwiki homestead tract, on which some clearing has been made, extends farther back on the south.

A staff gage, graduated in tenths of a foot from 4.0 to 11.8 feet, is bolted to a rock on the north bank and is used to obtain gage heights. A continuous record is obtained by means of a Barrett & Lawrence 34-day hydro-chronograph. (See fig. 4, p. 343.)

Measurements are made from a wire footbridge about 40 feet below the gage. The channel is exceedingly rough, although it has been improved by blasting so that fairly good results are obtainable.

A small ditch on the north side takes out of the Pohakupaa Stream about one-fourth mile above the station. With the exception of that diversion the discharge at this station gives the total flow of Honolii River at 1,425 feet elevation.

Discharge measurements of Honolii River at Kaiwiki, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 11	H. R. Schulz	61.5	88	5.72	100
14	do	62.0	87	5.52	79
15	do	61.5	78	5.40	63
16	do	63.0	112	6.00	160
Oct. 23	C. H. Pierce	58.0	60	5.20	27.9
Nov. 1 [a]	do	19.2	13	5.00	10.4
7	do	62.0	118	6.10	176
17	do	62.0	130	6.30	236

[a] Measurements made by wading about 200 feet above gage.

NOTE.—All measurements made from foot bridge at regular section except as noted.

Daily gage height, in feet, of Honolii River at Kaiwiki, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.50	5.76	5.05	5.70	7.40	5.00	5.27
2	5.40	6.12	5.02	5.50	6.15	5.00	5.22
3	5.62	6.80	5.10	5.60	6.35	5.10	5.20
4	6.25	6.20	5.10	6.30	7.80	5.20	5.17
5	7.10	6.20	.....	5.67	6.35	5.33	5.16
6	6.10	5.72	.....	5.54	5.98	5.90	5.15
7	6.80	5.90	.....	5.70	6.25	6.00	5.14
8	7.50	5.90	.....	6.40	6.45	5.92	5.35
9	7.00	6.32	.....	6.00	6.00	5.95	5.54
10	6.42	5.92	.....	5.60	5.85	5.55	5.45
11	6.00	5.71	4.95	9.00	5.65	5.38	5.40
12	5.65	5.68	4.98	6.75	5.50	5.30	5.33
13	5.65	5.58	5.00	5.82	5.40	5.45	6.05
14	5.55	5.55	5.00	5.88	5.33	5.55	7.35
15	5.65	6.70	5.05	6.40	5.70	6.30	8.50
16	5.55	6.00	5.12	6.00	5.58	5.62	8.00
17	5.65	5.65	5.48	5.70	5.65	6.10	7.60
18	5.65	5.48	5.35	6.50	5.40	6.29	7.20
19	5.65	5.40	9.65	5.70	5.30	7.60	7.05
20	5.48	5.45	5.98	5.45	5.25	6.15	7.15
21	5.55	5.42	5.45	5.35	5.20	7.70	6.15
22	5.98	5.35	5.30	5.98	5.18	7.75	5.68
23	5.58	5.38	5.22	7.50	5.17	8.20	5.52
24	5.45	5.25	5.35	7.20	5.15	7.70	5.50
25	5.52	5.20	5.95	6.44	5.13	6.25	6.50
26	6.09	5.15	5.50	6.40	5.12	5.72	5.63
27	5.79	5.12	5.30	6.30	5.09	5.50	5.50
28	5.60	5.10	5.46	6.35	5.08	5.40	6.00
29	5.52	5.08	7.70	6.00	5.07	5.35	6.40
30	5.64	5.12	9.25	6.50	5.05	5.25	5.58
31	.....	5.08	6.48	.....	5.03	.....	5.60

NOTE.—A Barrett & Lawrence 34-day hydro-chronograph was installed Aug. 27. Prior to that date gage heights were obtained from daily reading of staff gage.

Daily discharge, in second-feet, of Honolii River at Kaiwiki, near Hilo, Hawaii, for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	70	110	15	100	591	10	39
2	56	187	12	70	195	10	33
3	87	380	20	84	248	20	31
4	222	208	20	235	753	31	28
5	480	208	18	95	248	47	27
6	182	103	16	76	154	136	26
7	380	136	15	100	222	158	24
8	630	136	14	262	276	140	50
9	445	240	12	158	158	147	76
10	268	140	10	84	126	77	63
11	158	102	8.0	1,320	92	53	56
12	92	97	9.0	365	70	43	47
13	92	81	10	121	56	63	170
14	77	77	10	132	47	77	572
15	92	349	15	262	100	235	1,070
16	77	158	22	158	81	87	840
17	92	92	67	100	92	182	670
18	92	67	50	290	56	232	516
19	92	56	1,710	160	43	670	462
20	67	63	154	63	37	195	498
21	77	59	63	50	31	711	195
22	154	50	43	154	29	732	97
23	81	53	33	630	28	929	73
24	63	37	50	516	26	711	70
25	73	31	147	273	23	222	290
26	180	26	70	262	22	103	89
27	115	22	43	235	19	70	70
28	84	20	64	248	18	56	158
29	73	18	711	158	17	50	262
30	90	22	1,470	290	15	37	81
31	.....	18	284	.....	13	.....	84

NOTE.—Daily discharge computed from a rating curve well defined below 300 second-feet. Discharge interpolated for the period Aug. 5 to 10, there was no rain during this period, and the stream was steadily falling.

FIGURE 4.—Diagram showing fluctuation in stage of Honolii River at Kaiwiki, near Hilo, Hawaii.

Monthly discharge of Honolii River at Kaiwiki, near Hilo, Hawaii, for June 1–Dec. 31, 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June	630	56	158	9,400	A.
July	380	18	108	6,640	A.
August	1,710	8	167	10,300	A.
September	1,320	50	233	13,900	A.
October	753	13	125	7,690	A.
November	929	10	208	12,400	A.
December	1,070	24	218	13,400	A.
The period				73,700	

HONOLII DITCH AT KAIWIKI, NEAR HILO, HAWAII.

Honolii ditch diverts water from the north side of Pohakupaa Stream at elevation about 1,500 feet. The water is used for fluming cane on the plantation of the Onomea Sugar Co. and also for a domestic supply.

A staff gage was established in a flume about one-fourth mile below the intake in June, 1911. As no gage reader was available at this place an attampt was made to obtain the relation between gage heights on the ditch and on the Honolii River below as given by the clock register. There are no headgates at the diversion for artificial regulation of the flow, but owing to shifting of gravel and bowlders at high water no permanent relation between the two gages could be obtained. The maximum capacity of the ditch at the flume is 4.3 second-feet, and the average daily discharge from June 1 to December 31, 1911, was about 3.2 second-feet, as given by the comparative rating.

Discharge measurements of Honolii ditch at Kaiwiki, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 16	H. R. Schulz	2.3	2.07	1.10	4.25
Oct. 23	C. H. Pierce	2.3	0.76	0.60	0.97

NOTE.—Zero flow is at gage height 0.22. Measurements made in flume near the gage.

KAWAINUI RIVER BASIN.

GENERAL FEATURES.

The upper end of this basin lies between Kolekole on the north and Waipahoehoe on the south, with both of which it merges on the eastern slope of Mauna Kea. Near the sea other gulches appear, Waiaama being next on the north and Onomea on the south. In the forest at 2,500 feet elevation there are found two large forks of the Kawainui Stream and numerous smaller tributaries. These all unite at some distance above the cane belt, forming Kawainui River, which is the third stream in size in the Hilo group.

KAWAINUI RIVER AT KAWAINUI, NEAR PEPEEKEO, HAWAII.

A gaging station was established on Kawainui River at the highway bridge about one-half mile south of the railroad station at Kawainui, December 4, 1911. The station is about 100 feet below the end of the tunnel which carries the stream through the railroad embankment. A staff gage graduated to tenths of a foot and fastened to the north abutment of the bridge is used for obtaining gage heights. Low-water measurements are made by wading, and high-water measurements from the bridge.

The discharge at this station gives the total flow of the stream except for small diversions above for fluming cane (Pl. X, *A*).

Discharge measurements of Kawainui River at Kawainui, near Pepeekeo, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 21	Pierce and Schulz	22.3	32.9	.....	56
Mar. 24	H. R. Schulz	28.0	36.1	2.08	80
Nov. 28	C. H. Pierce	26.5	32.0	1.95	67

NOTE.—A low-water measurement obtained early in 1912 was used in determining the rating. The measurements were made by wading at various sections.

Daily gage height, in feet, of Kawainui River at Kawainui, near Pepeekeo, Hawaii, for 1911.

[Matsuna, observer.]

Day.	Dec.	Day.	Dec.	Day.	Dec.
1	.....	11	1.60	21	2.45
2	.....	12	1.65	22	2.35
3	.....	13	1.80	23	2.10
4	1.50	14	4.10	24	1.80
5	1.50	15	4.40	25	2.55
6	1.50	16	3.55	26	2.00
7	1.50	17	3.50	27	1.70
8	1.70	18	3.25	28	1.90
9	1.70	19	3.60	29	2.40
10	1.60	20	3.35	30	2.00
				31	2.60

Daily discharge, in second-feet, at Kawainui River at Kawainui, near Pepeekeo, Hawaii, for 1911.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1	.....	11	47	21	106
2	.....	12	50	22	98
3	.....	13	59	23	79
4	42	14	264	24	59
5	42	15	294	25	114
6	42	16	209	26	72
7	42	17	204	27	53
8	53	18	179	28	65
9	53	19	214	29	102
10	47	20	189	30	72
				31	119

NOTE.—Daily discharge computed from a rating curve that is poorly defined.

STATIONS AT 2,500-FOOT ELEVATION IN THE FOREST BACK OF HILO, HAWAII.

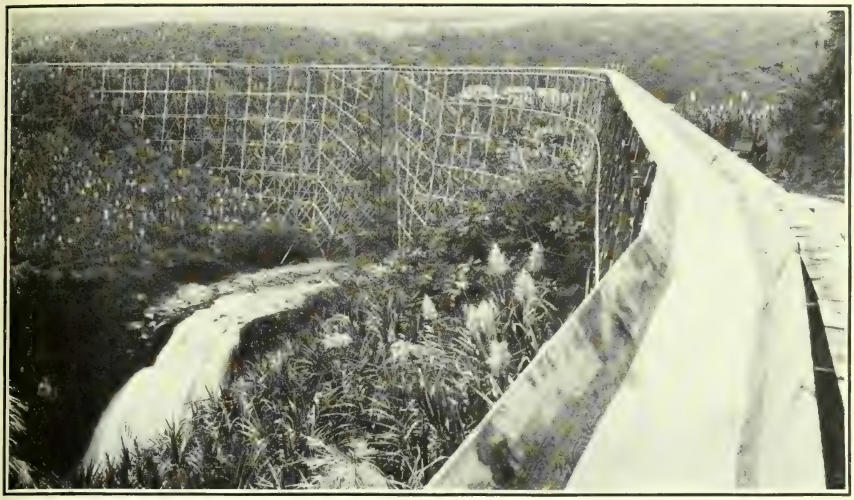
GENERAL FEATURES.

On account of the large quantity of water in the Hilo region and the comparatively arid conditions on the south side of the island it has been proposed to intercept the streams in the forest back of Hilo at approximately 2,500 feet above sea level and carry this water around the southeast end of the island for irrigation in the Kau district. In order to determine approximately the amount of water available at the 2,500-foot level, stations were put in on all streams from Wailuku River on the south northward as far as the north fork of Kawainui Stream. The stations, 81 in number, are on the 2,500-foot contour[1] as determined by aneroid, and cover a distance of 12 or 15 miles by trail. Staff gages were established on all the streams and frequent readings obtained during September, October, November, and December, 1911.

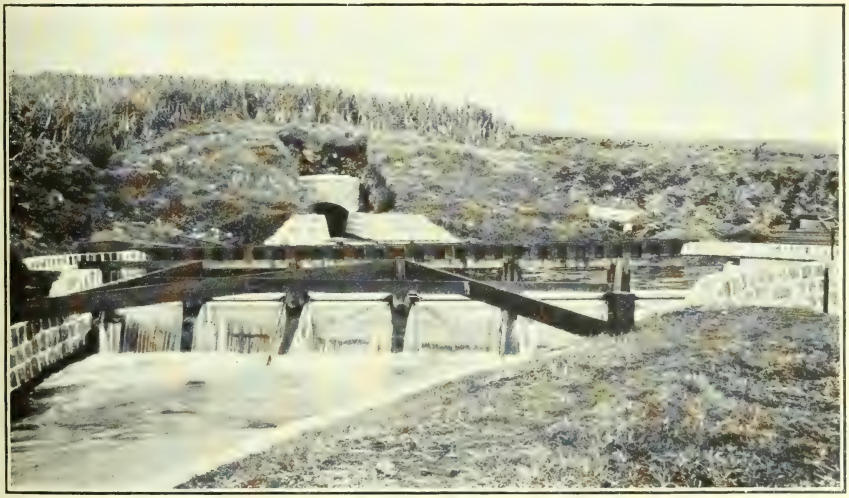
These stations are in a section of the country which is very difficult to reach. Above the cane belt it is impossible to travel except on foot. The main camp was established near the center of the line of stations and an effort made to get daily readings by sending men out each way to the end of the line. It was impossible, however, to get readings every day on account of the fact that all supplies had to be packed up by the men from below through several miles of forest morass. A line of rain gages was established from sea level up to 5,000 feet at intervals of 500 feet difference in elevation in order to determine the elevation of maximum rainfall. Daily precipitation records were also obtained at the central camp as an aid in determining the fluctuation of stream flow.

Owing to the limited amount of time available and the difficulty of getting measurements at high stages, only a few discharge measurements on each stream were obtained. These give a good idea of the amount of water usually carried by the streams, but they are not considered sufficient for determining a rating for all stages. For this reason no attempt is made to give estimates of daily discharge, but for every station is given the list of discharge measurements and gage heights obtained during 1911. The stations are numbered consecutively from 1 to 87, with the exception that numbers 19 to 24, inclusive, are not used—that is, stations No. 18 and No. 25 are on adjacent streams. The numbering begins with the Wailuku River on the south or Hilo end as station No. 1.

[1] Accurate determinations made later by topographers of the United States Geological Survey show the correct elevations of these stations to be from 200 to 250 feet greater than were indicated by aneroid. The correct elevation of the Geological Survey camp at station No. 50 is 2,750 feet.



A. CANE FLUME AND TRESTLE ACROSS KAWAINUI RIVER, NEAR PEPEEKEO, HAWAII.



B. WEIR ON NEW HAMAKUA DITCH AT KUKUIHAELE, HAWAII.

The table showing daily precipitation is given here as an aid for making estimates on the days when gage-height readings were not obtained.

COMBINED FLOW.

A study of the figures for the individual streams as they appear on the following pages will show that any stream by itself is quite insignificant except at high stages. It is the combined flow of all the streams that should be considered. The records obtained up to December 31, 1911, are for too short a period to admit of definite conclusions in regard to the amount of water available, but by making comparisons with the regular gaging stations on Wailuku and Honolii rivers, some idea may be had of the minimum flow to be expected. Such comparisons will have especial value because of the fact that 42 of the streams crossed in the forest at an elevation of 2,500 feet are tributary to the Wailuku River and 15 are tributary to the Honolii River, on both of which streams regular gaging stations are being maintained.

During the year 1911 there were three low-water periods in the Hilo group of streams. The first and lowest stage occurred during July and August, the lowest record being obtained on August 11. At this time the minimum discharge of Wailuku River at the gaging station near Hilo was 41 second-feet and that of Honolii River at the Kaiwiki gaging station was 8.0 second-feet. The second low-water period was during the last week of October and the first week of November, when the discharge of Wailuku River dropped to 77 second-feet on November 2 and that of Honolii River to 10 second-feet on the same date. At the third low stage, which occurred during the first week in December, the streams did not fall so low as in November. The lowest discharge of Wailuku River at this time was 126 second-feet on December 6 and that of Honolii River was 24 second-feet on December 7.

At the end of the dry period of October and November the combined flow of all the streams at 2,500 feet elevation tributary to Wailuku River (stations Nos. 1 to 48) was about 9.5 second-feet, as near as can be estimated, and that of the streams from stations Nos. 49 to 68 about 9.1 second-feet. Stations Nos. 69 to 87 were not in operation at this time, but at the next low-water period, during the first week in December, these 19 streams had a combined minimum flow of about 19 second-feet. By comparing the discharge at the Kaiwiki gaging station on Honolii River for these two periods it may be seen that the discharge on November 2 was less than one-half that of December 7. As the streams at 2,500 feet elevation between stations Nos. 69 and 87 would fall in about the same ratio as Honolii River, it is probable that the combined flow of the streams

between these two stations was in the neighborhood of 8 second-feet on November 2. This would give a total combined flow of all the streams from stations Nos. 1 to 87 of approximately 27 second-feet. Since the sum of the discharge of Wailuku and Honolii rivers at the lowest stage in August was only about one-half that of the low stage in November, it is probable that the combined flow of the streams at 2,500 feet elevation fell considerably below 20 second-feet during August, 1911.

Notwithstanding the fact that low-water periods like the above may be expected to occur at times, there can be no doubt but that the total run-off at this elevation is large. If it could all be saved and put to beneficial use it would be sufficient to satisfy all demands that could be made upon it. The drainage area within the forest cover that is drained by these streams above elevation 2,500 feet is more than 60 square miles, and the mean daily precipitation as determined by what records are available is about 0.48 inch.[1] This would give a daily precipitation of 1,540 acre-feet within the forested area alone. The rainfall at higher elevations would add materially to this and might be sufficient to offset the greater part of the amount lost by evaporation and taken up by the plant growth.

The great difficulty of conserving this water is the fact that a very large proportion of the run-off occurs during a small part of the time. The streams fluctuate greatly, and many that are mere rivulets at low stages become roaring torrents when fed by heavy rains of several days' duration. Storage capacity of a large amount will be necessary in order to provide for a constant supply at all times. It would be impracticable to construct any system of reservoirs in the big gulches, owing to the destructive torrents and the steep gradients, but it is very likely that a careful topographic survey will disclose numerous available sites on the swampy tracts crossed by the 2,500-foot contour. With sufficient storage capacity it is probable that a constant supply of 150 or 200 second-feet might easily be obtained from these streams. It is, however, necessary to obtain records over a much longer period of time than those given here and also to make enough discharge measurements to determine accurate ratings before any definite statement can be made as to the supply of water available in the forest at 2,500-foot elevation.

[1] The records for the United States Geological Survey special rainfall stations at elevations 2,500, 3,000, 3,500, 4,000, 4,500, and 5,000 feet up to the end of June, 1912, and the records for the United States Weather Bureau station at Puu Oo, elevation 6,450 feet, for the year 1911, were used in making this estimate.

Rainfall, in inches, at United States Geological Survey camp, elevation 2,500 feet, near Hilo, Hawaii, Sept. 6 to Dec. 31, 1911.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	0.01	0.00	21	0.01	0.06	0.87	0.60
2	.....	.....	.04	.00	22	.58	(t)	4.10	.02
3	.....	[d] 5.20	.63	.00	23	.....	.21	4.71	.04
4	.....	3.75	.97	.04	24	[e] 5.60	.05	4.02	.18
5	.....	.97	.98	.32	25	1.74	.05	1.41	2.25
6	(a)	.70	1.57	.25	26	.68	.29	.00	.01
7	0.61	.96	1.08	.11	27	1.54	.01	.00	.22
8	1.93	2.07	.59	.63	28	1.28	.13	.22	.63
9	.....	.73	1.08	1.63	29	.86	.19	.32	1.96
10	.....	.58	.62	.23	30	.85	.04	.03	.08
11	.....	.42	.26	.82	31	.....	.07	.....	.72
12	[b] 8.65	.06	.24	.16	The month	[e] 30.40	19.60	32.90	31.14
13	.01	.05	.68	2.02	Mean daily	1.27	0.63	1.10	1.00
14	.77	.04	.50	1.01					
15	1.75	1.42	1.89	4.42					
16	.85	.68	.38	4.10					
17	.17	.78	1.02	2.60					
18	2.21	.....	.73	1.67					
19	.27	.06	3.10	2.92					
20	.04	.03	.85	1.50					

[a] Gage installed.
[b] For 4 days, Sept. 9–12.
[c] For 2 days, Sept. 23 and 24.
[d] For 3 days, Oct. 1–3.
[e] For 24 days, Sept. 7–30.
[t] Trace of rain, but too small to measure.

NOTE.—The gage was of the standard United States Weather Bureau type and was read daily except when the hydrographers were working too far away to return to camp at night. The camp is located on Maili Stream, by station No. 50, and is about halfway between stations No. 1 and No. 87.

Discharge measurements at station No. 1 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	1.00	43.0
18	.....do	−0.05	9.8

NOTE.—This station is on the south branch or principal tributary of Wailuku River.

Daily gage height, in feet, at station No. 1 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	2.18	.....	.....	11	0.42	.....	0.18	21	.....	.....	2.12
2	.....	.....	−0.18	12	.....	.....	.12	22	.....	.....	1.50
3	.....	.....	− .10	13	.....	.....	1.12	23	.....	.....	1.10
4	.....	.....	− .15	14	.....	.....	1.82	24	.....	.....	.65
5	.....	.....	− .18	15	.....	0.95	3.42	25	.....	1.70	1.32
6	1.00	.....	− .32	16	.....	.88	2.32	26	−0.70	1.28	.92
7	.....	.....	− .48	17	.18	.....	2.55	27	.....	.95	.60
8	.....	.....	.15	18	−.05	.....	2.72	28	.....	.82	.58
9	.....	.32	.32	19	.....	.....	3.10	29	.....	.65	.75
10	.55	.20	.22	20	.....	.....	2.55	30	.....	.45	.....

Discharge measurements at station No. 2 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	0.55	0.04
18	do	.54	[a] .01

[a] Estimated.

NOTE.—This stream is tributary to the Wailuku River.

Daily gage height, in feet, at station No. 2 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1			[a]	11	0.52		[a]	21			0.55
2			[a]	12			[a]	22			[a]
3			[a]	13			0.58	23			[a]
4			[a]	14			.60	24			[a]
5			[a]	15		0.62	.65	25		0.60	.61
6	0.55		[a]	16		.61	.58	26	[a] .45	[a]	.55
7			[a]	17			.62	27		[a]	.56
8			[a]	18	.54		.64	28		[a]	.55
9		0.58	[a]	19			.66	29		[a]	.58
10	.52	.58	[a]	20			.62	30	[a]	[a]	
								31	[a]		

[a] No flow.

Discharge measurements at station No. 3 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	0.90	19.3
18	do	.22	4.17

NOTE.—This stream is tributary to the Wailuku River.

Daily gage height, in feet, at station No. 3 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	1.45			11	0.55		0.15	21			1.49
2			0.10	12			.11	22			1.25
3			−.05	13			.82	23			1.02
4			−.05	14			1.32	24			.71
5			−.06	15		1.02	2.18	25		1.24	1.28
6	.92		−.09	16		1.00	1.58	26	−0.10	.90	.92
7			−.04	17			1.92	27		.72	.70
8			.11	18	.08		2.25	28		.70	.38
9		0.75	.32	19			2.52	29		.52	.81
10	.65	.69	.12	20			2.02	30	−.20	.38	
								31	−.18		

Discharge measurements at station No. 4 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	0.78	0.58
18	.....do	.72	.32

NOTE.—This stream is tributary to the Wailuku River.

Daily gage height, in feet, at station No. 4 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.82	.....	.....	11	0.75	.....	0.74	21	.....	.....	0.75
2	.....	.....	0.70	12	.....	.....	.72	22	.....	.....	.72
3	.....	.....	.70	13	.....	.....	.78	23	.....	.....	.71
4	.....	.....	.71	14	.....	.....	.82	24	.....	.....	.70
5	.....	.....	.72	15	.....	0.73	.88	25	.....	0.78	.80
6	.78	.....	.70	16	.....	.71	.88	26	0.69	.75	.75
7	.....	.....	.70	17	.....	.....	.82	27	.....	.74	.74
8	.....	.....	.72	18	.71	.....	.82	28	.....	.75	.72
9	.....	0.72	.75	19	.....	.....	.84	29	.....	.72	.76
10	.75	.69	.72	20	.....	.....	.78	30	.65	.71	.....
								31	.66	.....	.....

Discharge measurements at station No. 5 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	0.61	0.17
18	.....do	.55	.19

NOTE.—This stream is tributary to the Wailuku River.

Daily gage height, in feet, at station No. 5 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.78	.....	.....	11	0.60	.....	0.56	21	.....	.....	0.64
2	.....	.....	0.52	12	.....	.....	.54	22	.....	.....	.61
3	.....	.....	.51	13	.....	.....	.60	23	.....	.....	.60
4	.....	.....	.52	14	.....	.....	.68	24	.....	.....	.58
5	.....	.....	.54	15	.....	0.60	.68	25	.....	0.61	.68
6	.61	.....	.52	16	.....	.60	.88	26	0.50	.60	.60
7	.....	.....	.51	17	.....	.....	.65	27	.....	.60	.60
8	.....	.....	.54	18	.55	.....	.65	28	.....	.61	.60
9	.....	0.58	.58	19	.....	.....	.66	29	.....	.59	.60
10	.60	.59	.54	20	.....	.....	.66	30	.50	.58	.....
								31	.48	.....	

Discharge measurements at station No. 6 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	0.48	0.07
18	do	.15	.00

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 6 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	0.40	.....	0.34	21	.....	.....	0.32
2	.....	.....	(a)	12	.....	.....	.31	22	.....	.....	.31
3	.....	.....	(a)	13	.....	.....	.40	23	.....	.....	(a)
4	.....	.....	0.30	14	.....	.....	.46	24	.....	.....	(a)
5	.....	.....	.31	15	.....	0.40	.48	25	.....	0.44	.40
6	0.48	.....	(a)	16	.....	.41	.35	26	(a)	.34	.38
7	.....	.....	(a)	17	.....	.....	.41	27	.....	.31	.32
8	.....	.....	.31	18	a .15	.....	.42	28	.....	.32	.32
9	.....	0.34	.34	19	.....	.....	.44	29	.....	.31	.36
10	.40	.30	.31	20	.....	.....	.35	30	(a)	.30	.....
								31	(a)	.....	.....

a No flow.

Discharge measurements at station No. 7 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft*
Oct. 6	C. H. Pierce	0.45	0.08
18	do	.40	.05

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 7 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	0.44	.....	0.31	21	.....	.....	0.38
2	.....	.....	0.29	12	.....	.....	.30	22	.....	.....	.35
3	.....	.....	.28	13	.....	.....	.41	23	.....	.....	.34
4	.....	.....	.30	14	.....	.....	.48	24	.....	.....	.32
5	.....	.....	.32	15	.....	0.47	.50	25	.....	0.44	.42
6	0.45	.....	.30	16	.....	.41	.35	26	0.30	.40	.40
7	.....	.....	.28	17	.....	.....	.44	27	.....	.36	.34
8	.....	.....	.30	18	.40	.....	.45	28	.....	.38	.32
9	.....	0.44	.32	19	.....	.....	.45	29	.....	.35	.36
10	.42	.41	.30	20	.....	.....	.41	30	.27	.31	.....
								31	.26	.....	.....

Discharge measurements at station No. 8 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	0.98	1.03
18	....do	.85	.57

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 8 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	1.28	.....	.....	11	0.91	.....	0.74	21	.....	.....	0.85
2	.....	.....	0.72	12	.....	.....	.71	22	.....	.....	.85
3	.....	.....	.71	13	.....	.....	.91	23	.....	.....	.81
4	.....	.....	.72	14	.....	.....	1.08	24	.....	.....	.75
5	.....	.....	.75	15	.....	1.02	1.15	25	.....	1.10	.92
6	.98	.....	.72	16	.....	1.00	.85	26	0.68	.99	.82
7	.....	.....	.70	17	.....	.....	1.02	27	.....	.92	.80
8	.....	.....	.71	18	.85	.....	1.00	28	.....	.92	.80
9	.....	1.12	.75	19	.....	.....	1.05	29	.....	.88	.95
10	.92	.91	.72	20	.....	.....	.92	30	.62	.81	.....
								31	.62	.....	.....

Discharge measurements at station No. 9 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	0.69	1.05
18	....do	.59	.19

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 9 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.90	.....	.....	11	0.62	.....	0.55	21	.....	.....	0.61
2	.....	.....	0.51	12	.....	.....	.54	22	.....	.....	.59
3	.....	.....	.50	13	.....	.....	.65	23	.....	.....	.58
4	.....	.....	.51	14	.....	.....	.70	24	.....	.....	.55
5	.....	.....	.54	15	.....	0.65	.82	25	.....	0.75	.82
6	.69	.....	.51	16	.....	.61	.92	26	0.51	.65	.75
7	.....	.....	.50	17	.....	.....	.96	27	.....	.61	.58
8	.....	.....	.51	18	.59	.....	.88	28	.....	.61	.56
9	.....	0.64	.56	19	.....	.....	.80	29	.....	.60	.64
10	.62	.61	.54	20	.....	.....	.72	30	.50	.58	.....
								31	.50	.....	.....

Discharge measurements at station No. 10 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Oct. 6	C. H. Pierce	0.92	0.28
18	.....do	.75	.00

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 10 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	1.08	.....	.....	11	0.85	.....	0.80	21	.....	.....	0.78
2	.....	.....	(a)	12	.....	.....	a.75	22	.....	.....	a.75
3	.....	.....	(a)	13	.....	.....	.92	23	.....	.....	a.75
4	.....	.....	0.76	14	.....	.....	.94	24	.....	.....	(a)
5	.....	.....	(a)	15	.....	0.79	1.12	25	.....	0.98	1.02
6	.92	.....	(a)	16	.....	.76	1.35	26	(a)	.90	.88
7	.....	.....	(a)	17	.....	.....	1.28	27	.....	.86	.81
8	.....	.....	.78	18	a.75	.....	1.28	28	.....	.85	.79
9	.....	(a)	.80	19	.....	.....	1.01	29	.....	.80	.98
10	.90	(a)	.76	20	.....	.....	.85	30	(a)	.76	.....
								31	(a)	.....	.....

a No flow.

Discharge measurements at station No. 11 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Oct. 6	C. H. Pierce	0.45	0.94
18	.....do	.28	a.01

a Estimated.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 11 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	0.35	.....	0.35	21	.....	.....	0.40
2	.....	.....	(a)	12	.....	.....	.34	22	.....	.....	.35
3	.....	.....	(a)	13	.....	.....	.42	23	.....	.....	.32
4	.....	.....	(a)	14	.....	.....	.48	24	.....	.....	(a)
5	.....	.....	0.31	15	.....	0.44	.55	25	.....	0.50	.45
6	0.45	.....	(a)	16	.....	.42	.32	26	(a)	.40	.38
7	.....	.....	(a)	17	.....	.....	.46	27	.....	.38	.35
8	.....	.....	.31	18	.28	.....	.48	28	.....	.38	.35
9	.....	0.31	.34	19	.....	.....	.50	29	.....	.36	.40
10	.41	.24	.32	20	.....	.....	.40	30	(a)	.31	.....
								31	(a)	.....	.....

a No flow.

Discharge measurements at station No. 12 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6	C. H. Pierce	1.40	21.0
17	do	1.15	5.2
18	do	1.10	4.10

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 12 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	1.88	.....	.....	11	1.22	.....	0.98	21	.....	.....	1.72
2	.....	.....	1.00	12	.....	.....	.95	22	.....	.....	1.45
3	.....	.....	.98	13	.....	.....	1.32	23	.....	.....	1.35
4	.....	.....	1.00	14	.....	.....	1.41	24	.....	.....	1.30
5	.....	.....	1.02	15	.....	1.42	1.70	25	.....	1.61	1.75
6	1.40	.....	.95	16	.....	1.38	2.32	26	0.91	1.38	1.52
7	.....	.....	.92	17	1.15	.....	2.62	27	.....	1.22	1.45
8	.....	.....	.94	18	1.10	.....	2.68	28	.....	1.24	1.44
9	.....	1.34	.98	19	.....	.....	2.72	29	.....	1.15	1.72
10	1.30	1.30	.92	20	.....	.....	2.28	30	.85	1.09	.....
								31	.85	.....	.....

Discharge measurements at station No. 13 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	1.50	27.0
17	do	1.00	7.9
18	do	.90	5.5

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 13 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	1.95	.....	.....	11	1.05	.....	0.72	21	.....	.....	1.62
2	.....	.....	0.75	12	.....	.....	.71	22	.....	.....	1.51
3	.....	.....	.72	13	.....	.....	1.12	23	.....	.....	1.35
4	.....	.....	.75	14	.....	.....	2.25	24	.....	.....	1.12
5	1.50	.....	.78	15	.....	1.28	2.62	25	.....	1.52	1.85
6	1.26	.....	.70	16	.....	1.12	2.25	26	0.68	1.29	1.60
7	.....	.....	.65	17	1.00	.....	2.48	27	.....	1.18	1.45
8	.....	.....	.68	18	.90	.....	2.42	28	.....	1.16	1.41
9	.....	1.22	.71	19	.....	.....	2.49	29	.....	1.11	1.68
10	1.10	1.15	.70	20	.....	.....	2.10	30	.52	1.08	.....
								31	.56	.....	.....

Discharge measurements at station No. 14 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	1.05	0.29
17	.....do	.82	.08

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 14 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1910.				1910.				1910.			
1	1.25	.....	.....	11	0.90	.....	0.79	21	.....	.....	1.09
2	.....	.....	0.75	12	.....	.....	.75	22	.....	.....	1.02
3	.....	.....	.74	13	.....	.....	.96	23	.....	.....	.99
4	.....	.....	.75	14	.....	.....	1.02	24	.....	.....	.81
5	1.05	.....	.76	15	.....	0.83	1.38	25	.....	1.08	1.05
6	.99	.....	.72	16	.....	.81	.98	26	0.71	.99	.98
7	.....	.....	.71	17	.82	.....	1.25	27	.....	.92	.90
8	.....	.....	.74	18	.80	.....	1.20	28	.....	.92	.90
9	.....	0.88	.78	19	.....	.....	1.26	29	.....	.86	1.12
10	.91	.84	.74	20	.....	.....	1.12	30	.70	.82	.....
								31	.70	.....	.....

Discharge measurements at station No. 15 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	1.45	12.6
17	.....do	1.21	2.99

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 15 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1910.				1910.				1910.			
1	1.62	.....	.....	11	1.25	.....	1.06	21	.....	.....	1.32
2	.....	.....	1.08	12	.....	.....	1.01	22	.....	.....	1.25
3	.....	.....	1.05	13	.....	.....	1.30	23	.....	.....	1.20
4	.....	.....	1.05	14	.....	.....	1.50	24	.....	.....	1.15
5	1.45	.....	1.08	15	.....	1.36	1.75	25	1.04	1.45	1.62
6	1.36	.....	1.05	16	.....	1.28	1.36	26	.....	1.32	1.51
7	.....	.....	1.02	17	1.21	.....	1.72	27	.....	1.28	1.38
8	.....	.....	1.02	18	1.18	.....	1.78	28	.....	1.28	1.31
9	.....	1.32	1.05	19	.....	.....	1.84	29	.....	1.21	1.52
10	1.29	1.28	1.00	20	.....	.....	1.48	30	.99	1.15	.....
								31	1.00	.....	.....

Discharge measurements at station No. 16 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	0.70	0.50
17	.....do	.60	.06

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 16 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.80	.....	.....	11	0.62	.....	0.52	21	.....	.....	0.65
2	.....	.....	0.44	12	.....	.....	.51	22	.....	.....	.62
3	.....	.....	.42	13	.....	.....	.68	23	.....	.....	.61
4	.....	.....	.44	14	.....	.....	.75	24	.....	.....	.60
5	.70	.....	.45	15	.....	0.63	.92	25	.....	0.72	.82
6	.68	.....	.42	16	.....	.61	.61	26	0.52	.62	.78
7	.....	.....	.42	17	.60	.....	.90	27	.....	.58	.70
8	.....	.....	.44	18	.60	.....	.85	28	.....	.59	.69
9	.....	0.64	.51	19	.....	.....	.92	29	.....	.54	.80
10	.64	.68	.48	20	.....	.....	.78	30	.42	.49	.....
								31	.42	.....	.....

Discharge measurements at station No. 17 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	0.80	0.26
17	.....do	.70	.10

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 17 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.88	.....	.....	11	0.72	.....	0.69	21	.....	.....	0.75
2	.....	.....	0.66	12	.....	.....	.65	22	.....	.....	.72
3	.....	.....	.65	13	.....	.....	.75	23	.....	.....	.71
4	.....	.....	.65	14	.....	.....	.82	24	.....	.....	.70
5	.80	.....	.66	15	.....	0.79	1.05	25	.....	0.80	.92
6	.80	.....	.64	16	.....	.75	.75	26	0.65	.75	.85
7	.....	.....	.62	17	.70	.....	.99	27	.....	.71	.80
8	.....	.....	.64	18	.71	.....	.98	28	.....	.72	.78
9	.....	0.80	.68	19	.....	.....	1.01	29	.....	.70	.82
10	.74	.79	.65	20	.....	.....	.86	30	.65	.69	.....
								31	.66	.....	.....

Discharge measurements at station No. 18 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	0.65	0.08
17	....do	.60	.04

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 18 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.72			11	0.60		0.56	21			0.62
2			0.54	12			.54	22			.61
3			.52	13			.61	23			.60
4			.54	14			.65	24			.55
5	.65		.55	15		0.60	.92	25		0.62	.72
6	.61		.55	16		.59	.61	26	0.54	.61	.65
7			.52	17	.60		.91	27		.60	.61
8			.54	18	.58		.89	28		.60	.60
9		0.60	.58	19			.92	29		.59	.72
10	.60	.61	.55	20			.75	30	.52	.58	
								31	.52		

Discharge measurements at station No. 25 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	0.45	1.97
17	....do	.42	.34

NOTE.—This stream is next north of No. 18, the numbers 19 to 24 not being used. It is tributary to Wailuku River.

Daily gage height, in feet, at station No. 25 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.80			11	0.52		0.32	21			0.71
2			0.30	12			.31	22			.52
3			.30	13			.62	23			.48
4			.31	14			.72	24			.45
5	.45		.35	15		0.62	1.05	25		0.78	.88
6	.40		.25	16		.60	.72	26	0.25	.64	.78
7			.25	17	.42		1.02	27		.60	.65
8			.28	18	.38		.98	28		.61	.65
9		0.60	.31	19			1.04	29		.60	.78
10	.51	.78	.30	20			.82	30	.05	.52	
								31	.15		

Discharge measurements at station No. 26 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	0.80	0.20
17	do	.72	.04

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 26 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	0.88	.....	.....	11	0.72	.....	0.75	21	.....	.....	0.78
2	.80	.....	0.70	12	.....	.....	.72	22	.....	.....	.72
3	.....	.....	.70	13	.....	.....	.78	23	.....	.....	.70
4	.....	.....	.71	14	.....	.....	.85	24	.....	.....	.70
5	.80	.....	.72	15	.....	0.72	1.12	25	.....	0.81	.95
6	.78	.....	.70	16	.....	.71	.82	26	0.70	.79	.89
7	.....	.....	.70	17	.72	.....	1.05	27	.70	.74	.78
8	.....	.....	.71	18	.70	.....	1.00	28	.....	.75	.75
9	.....	0.73	.74	19	.70	.....	1.02	29	.....	.72	.85
10	.71	.72	.72	20	.....	.....	.85	30	.70	.71	.....
								31	.70	.....	.....

Discharge measurements at station No. 27 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 5	C. H. Pierce	2.14	21.2
17	do	1.75	4.99
19	do	1.55	2.76

NOTE.—This station is on the south fork of Kapehu Stream, which is tributary to Wailuku River.

Daily gage height, in feet, at station No. 27 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	1.79	.....	1.44	21	.....	.....	.....	2.10
2	.....	2.05	.....	1.45	12	.....	.....	.....	1.40	22	.....	.....	.....	1.85
3	.....	.....	.....	1.42	13	.....	.....	.....	1.95	23	.....	.....	.....	1.72
4	.....	.....	.....	1.40	14	.....	.....	.....	2.10	24	.....	.....	.....	1.58
5	.....	2.14	.....	1.41	15	.....	.....	2.10	2.85	25	.....	.....	2.12	2.15
6	.....	.....	.....	1.40	16	.....	.....	1.80	2.38	26	.....	1.38	1.90	1.88
7	.....	1.95	.....	1.35	17	.....	1.75	.....	2.65	27	.....	1.34	1.75	1.80
8	.....	.....	.....	1.36	18	.....	1.60	.....	2.65	28	2.02	.....	1.68	1.75
9	.....	.....	1.88	1.48	19	.....	1.55	.....	2.85	29	2.00	.....	1.52	1.92
10	.....	1.85	1.80	1.42	20	.....	.....	.....	2.42	30	.....	1.25	1.49	.....
										31	.....	1.28	.....	.....

Discharge measurements at station No. 28 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	2.00	37.9
Oct. 17	do	1.45	14.9
19	do	1.10	5.7

NOTE.—This station is on the north fork of Kapehu Stream, which is tributary to Wailuku River.

Daily gage height, in feet, at station No. 28 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		1.55		1.10	21				1.88
2		2.10		0.98	12				1.05	22				1.80
3				.92	13				1.72	23				1.75
4				.95	14				2.05	24				1.70
5		2.10		.98	15			2.20	2.95	25			2.10	2.22
6				.88	16			1.55	2.25	26		0.75	1.70	2.00
7		1.80		.78	17		1.45		2.48	27		.68	1.50	1.90
8				.80	18		1.15		2.50	28	2.00		1.45	1.78
9			1.68	1.12	19		1.10		2.72	29	1.80		1.35	2.00
10		1.62	1.48	1.08	20				2.35	30		.55	1.24	
										31		.60		

Discharge measurements at station No. 29 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	0.60	0.02
Oct. 19	do	(a)	.00

a Stream dry.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 29 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.38		(a)	21				0.39
2		0.58		(a)	12				(a)	22				.40
3				(a)	13				0.40	23				.41
4				(a)	14				.71	24				.40
5		.40		(a)	15			0.40	.85	25			0.44	.65
6				(a)	16			.40	.66	26	0.70	(a)	.39	.60
7		.40		(a)	17		.40		.81	27	.58	(a)	a .35	.60
8				(a)	18				.79	28	.60		a .35	.58
9			0.40	(a)	19		(a)		.81	29	.52		(a)	.72
10		.40	.38	(a)	20				.52	30		(a)	(a)	
										31		(a)		

a No flow.

Discharge measurements at station No. 30 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	0.85	0.20
Oct. 19	do	.52	*a*.01

a Estimated.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 30 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	0.72	.....	0.64	21	.....	.....	.....	0.71
2	.....	0.72	.....	0.50	12	.....	.....	.....	.61	22	.....	.....	.....	.64
3	.....	.....	.....	.49	13	.....	.....	.....	.75	23	.....	.....	.....	.61
4	.....	.....	.....	.51	14	.....	.....	.....	1.02	24	.....	.....	.....	.58
5	.....	.80	.....	.59	15	.....	.....	0.78	1.35	25	.....	.....	0.81	1.01
6	.....	.....	.....	.59	16	.....	.....	.72	.85	26	1.08	0.52	.70	.80
7	.....	.75	.....	.50	17	.....	.70	.....	1.16	27	.82	.50	.64	.78
8	.....	.....	.....	.52	18	.....	.....	.....	1.14	28	.85	.....	.65	.78
9	.....	.....	0.70	.62	19	.....	.52	.....	1.22	29	.75	.....	.61	.95
10	.....	.72	.64	.60	20	.....	.....	.....	.95	30	.....	.49	.58	.....
										31	.....	.48	.....	.....

Discharge measurements at station No. 31 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	1.35	22.0
Oct. 19	do	.80	4.26

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 31 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	1.05	.....	0.74	21	.....	.....	.....	1.15
2	.....	1.21	.....	0.70	12	.....	.....	.....	.71	22	.....	0.72	.....	1.00
3	.....	.....	.....	.68	13	.....	.....	.....	.95	23	.....	.....	.....	.95
4	.....	.....	.....	.69	14	.....	.....	.....	1.25	24	.....	.....	.....	.90
5	.....	1.30	.....	.71	15	.....	.....	1.22	1.62	25	.....	.....	1.25	1.42
6	.....	.....	.....	.68	16	.....	.....	.95	1.18	26	1.58	.70	.98	1.31
7	.....	1.14	.....	.64	17	.....	1.10	.....	1.52	27	1.38	.65	.82	1.30
8	.....	.....	.....	.66	18	.....	.....	.....	1.52	28	1.35	.....	.81	1.26
9	.....	.....	1.14	.72	19	.....	.80	.....	1.62	29	1.20	.....	.78	1.40
10	.....	1.15	1.00	.70	20	.....	.....	.....	1.40	30	.....	.60	.72	.....
										31	.....	.60	.....	.....

Discharge measurements at station No. 32 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	1.00	2.27
Oct. 19	do	.60	.43

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 32 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.88		0.62	21				1.02
2		1.00		0.60	12				.60	22		0.49		.82
3				.52	13				.88	23				.79
4				.52	14				1.15	24				.75
5		1.04		.55	15			0.82	1.52	25			1.02	1.21
6				.50	16			.70	1.05	26	1.12	.45	.88	.98
7		.95		.46	17		.85		1.38	27	.95	.45	.75	.95
8				.50	18				1.31	28	1.00		.75	.94
9			0.72	.62	19		.60		1.45	29	.90		.71	1.12
10		.92	.64	.60	20				1.21	30		.41	.65	
										31		.40		

Discharge measurements at station No. 33 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	1.10	0.35
Oct. 19	do	.80	.06

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 33 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		1.08		0.82	21				0.96
2		1.10		0.72	12				.80	22		0.70		.85
3				.71	13				.92	23				.82
4				.72	14				1.25	24				.80
5		1.20		.75	15			1.15	1.62	25			1.02	1.32
6				.75	16			1.02	1.18	26	1.20	.69	.85	1.15
7		1.15		.72	17		1.10		1.46	27	1.08	[a].60	.81	1.12
8				.74	18				1.42	28	1.10		.79	1.10
9			1.10	.81	19		.80		1.50	29	1.10		.76	1.30
10		1.15	1.10	.78	20				1.22	30		(a)	.75	
										31		(a)		

[a] No flow.

Discharge measurements at station No. 34 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	1.50	6.5
Oct. 19	do	1.09	.67

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 34 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		1.25		1.05	21				1.32
2		1.38		1.00	12				1.01	22		1.00		1.18
3				.98	13				1.25	23				1.12
4				.99	14				1.42	24				1.05
5		1.40		1.01	15			1.38	1.85	25			1.48	1.62
6				.98	16			1.18	1.28	26		.99	1.22	1.45
7		1.30		.92	17		1.25		1.66	27	1.50	.95	1.18	1.45
8					18				1.65	28	1.50		1.18	1.40
9			1.31	1.05	19		1.09		1.71	29	1.35		1.11	1.62
10		1.32	1.20	1.02	20				1.52	30		.90	1.05	
										31		.90		

Discharge measurements at station No. 35 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	0.40	0.08
Oct. 19	do	(a)	.00

[a] Stream dry.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 35 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.35		0.34	21				0.40
2		0.45		(a)	12				a.32	22		(a)		.40
3				(a)	13				.41	23				.40
4				(a)	14				.55	24				.38
5		.35		(a)	15			0.35	.72	25			0.40	.55
6				(a)	16			a.32	.55	26		(a)	.35	.50
7		.35		(a)	17		(a)		.68	27	0.41	(a)	(a)	.50
8				(a)	18				.65	28	.40		(a)	.50
9			0.35	(a)	19		(a)		.66	29	.38		(a)	.56
10		.38	(a)	(a)	20				.52	30		(a)	(a)	
										31		(a)		

[a] No flow.

Discharge measurements at station No. 36 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	0.58	0.11
Oct. 19	do	(a)	.00

[a] Stream dry.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 36 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		[a]0.45		0.49	21				0.58
2		0.52		(a)	12				.46	22		(a)		.54
3				(a)	13				.52	23				.51
4				(a)	14				.68	24				.49
5		.51		(a)	15			0.55	.92	25			0.55	.78
6				(a)	16			.50	.62	26		(a)	.50	.70
7		.50		(a)	17		.50		.85	27	0.54	(a)	.48	.70
8				(a)	18				.81	28	.58		.48	.68
9			0.59	0.48	19		(a)		.82	29	.50		(a)	.72
10		.50	.52	(a)	20				.71	30		(a)	(a)	
										31		(a)		

[a] No flow.

Discharge measurements at station No. 37 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	0.55	0.05
Oct. 19	do	.49	a.01

[a] Estimated.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 37 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.50		0.56	21				0.55
2		0.52		0.50	12				.54	22		(a)		.51
3				.50	13				.59	23				.50
4				.51	14				.72	24				.50
5		.52		.52	15			0.55	1.05	25			0.60	.85
6				.50	16			.52	.65	26		0.49	.54	.80
7		.50		.50	17		.52		.94	27	0.58	(a)	.51	.80
8				.51	18				.94	28	.55		.52	.75
9			0.52	.55	19		.49		.92	29	.50		.51	.84
10		.50	.50	.52	20				.65	30		(a)	.51	
										31		(a)		

[a] No flow.

Discharge measurements at station No. 38 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	1.00	0.75
Oct. 19	do	.81	.04

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 38 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.88		0.76	21				0.85
2		0.90		0.70	12				.75	22		0.78		.76
3				.70	13				.88	23				.74
4				.71	14				1.12	24				.71
5		.91		.72	15			0.95	1.50	25			0.90	1.18
6				.70	16			.90	1.08	26		.80	.80	1.02
7		.90		.70	17		.90		1.39	27	0.98	.71	.74	1.00
8				.71	18				1.41	28	1.00		.75	1.01
9			0.94	.75	19		.81		1.38	29	.90		.74	1.20
10		.90	.90	.72	20				1.00	30		.74	.72	
										31		.72		

Discharge measurements at station No. 39 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	1.08	1.72
Oct. 19	do	.85	.26

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 39 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.92		0.85	21				1.00
2		1.00		0.80	12				.80	22		0.80		.91
3				.80	13				.92	23				.89
4				.81	14				1.20	24				.82
5		1.01		.84	15			1.00	1.48	25			1.02	1.32
6				.80	16			.91	1.06	26		.82	.91	1.25
7		.95		.80	17		.95		1.40	27	1.05	.80	.89	1.28
8				.81	18				1.41	28	1.08		.88	1.20
9			0.98	.84	19		.85		1.38	29	1.00		.86	1.40
10		1.00	.91	.82	20				1.15	30		.80	.84	
										31		.80		

Discharge measurements at station No. 40 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 28	C. H. Pierce	1.45	0.93
Oct. 19	do	1.20	.06

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 40 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		1.30		1.06	21				1.38
2		1.38		1.14	12				1.02	22		1.15		1.25
3				1.08	13				1.28	23				1.22
4				1.05	14				1.41	24				1.15
5		1.40		1.08	15			1.28	1.62	25			1.40	1.50
6				1.09	16			1.21	1.24	26		1.10	1.32	1.35
7		1.32		1.02	17		1.22		1.45	27	1.40	1.08	1.24	1.35
8				1.05	18				1.48	28	1.45		1.22	1.32
9			1.35	1.15	19		1.20		1.45	29	1.40		1.18	1.39
10		1.32	1.28	1.02	20				1.52	30		(a)	1.16	
										31		(a)		

a No flow.

Discharge measurements at station No. 41 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 26	C. H. Pierce	1.92	10.5
Oct. 19	do	1.10	.83

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 41 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		1.42		0.84	21	0.92			1.60
2		1.50		0.75	12				.81	22	1.25	0 70		1.40
3				.52	13				1.22	23	1.80			1.31
4				.51	14				1.40	24	1.80			1.15
5		1.62		.52	15			1.62	2.20	25			1.72	2.30
6				.72	16			1.35	2.49	26	1.98	.75	1.35	1.95
7		1.50		.60	17		1.50		2.61	27	1.66	.50	1.18	1.90
8				.61	18				2.72	28	1.75		1.15	1.85
9			1.50	.82	19	1.30	1.10		2.65	29	1.50		.98	2.02
10		1.60	1.28	.80	20				2.35	30		.29	.85	
										31		.22		

Discharge measurements at station No. 42 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 26	C. H. Pierce	0.40	0.23
" 28[a]	do	.85	.15
Oct. 19	do	.65	[b].01

[a] Gage moved to new location with different datum. [b] Estimated.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 42 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	0.72	.....	0.61	21	.....	.....	.....	0.75
2	.....	0.80	.....	(b)	12	.....	.....	.....	.60	22	0.28	(b)	.....	.69
3	.....	.....	.....	(b)	13	.....	.....	.....	.71	23	.30	.....	.....	.68
4	.....	.....	.....	(b)	14	.....	.....	.....	.88	24	.40	.....	.....	.64
5	.....	.....	.....	(b)	15	.....	.....	0.72	1.12	25	.40	.....	0.82	1.00
6	.....	.....	.....	(b)	16	.....	.....	.72	.90	26	.40	(b)	.70	.85
7	.....	.75	.....	(b)	17	.....	.75	.....	1.08	27	[a].80	(b)	.65	.85
8	.....	.....	.....	(b)	18	.....	.....	.....	1.14	28	.85	.....	.65	.82
9	.....	.....	0.73	0.62	19	0.30	.65	.....	1.10	29	.80	.....	.62	.95
10	.....	.78	.74	.60	20	.....	.....	.....	.90	30	.....	(b)	.60	.....
										31	.....	(b)	.....	.....

[a] New gage installed at different datum. [b] No flow.

Discharge measurements at station No. 43 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 26	C. H. Pierce	0.86	0.68
Oct. 19	do	.24	.11

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 43 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	0.54	.....	0.26	21	0.20	.....	.....	0.35
2	.....	0.71	.....	0.18	12	.....	.....	.....	.25	22	.25	0.20	.....	.22
3	.....	.....	.....	.18	13	.....	.....	.....	.32	23	.80	.....	.....	.21
4	.....	.....	.....	.19	14	.....	.....	.....	.58	24	.82	.....	.....	.20
5	.....	.45	.....	.22	15	.....	.....	0.50	.85	25	.....	.....	0.46	.55
6	.....	.....	.....	.21	16	.....	.....	.38	.52	26	.88	.20	.30	.50
7	.....	.40	.....	.20	17	.....	.40	.....	.76	27	.82	.20	.25	.52
8	.....	.....	.....	.21	18	.....	.....	.....	.88	28	.82	.....	.25	.50
9	.....	.....	0.32	.25	19	0.30	.24	.....	.85	29	.70	.....	.24	.61
10	.....	.40	.32	.24	20	.....	.....	.....	.65	30	.....	.20	.22	.....
										31	.....	.20	.....	.....

Discharge measurements at station No. 44 at elevation 2,500 feet, near Hilo, Hawaii, in 1911

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 26	C. H. Pierce	0.55	0.06
Oct. 19	do	.45	*a* .01

a Estimated.

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 44 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.50		0.44	21	0.50			0.50
2		0.52		0.42	12				.41	22	.50	0.44		.45
3				.42	13				.48	23	.50			.45
4				.42	14				.55	24	.55			.42
5		.52		.45	15			0.50	.72	25			0.50	.58
6				.44	16			.30	.48	26	.56	.44	.45	.52
7		.50		.42	17		.49		.64	27	.54	.42	.45	.55
8				.44	18				.68	28	.55		.44	.51
9			0.50	.45	19	0.50	.45		.62	29	.50		.44	.58
10		.50	.49	.42	20				.55	30		.42	.42	
										31		.42		

Discharge measurements at station No. 45 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 26	C. H. Pierce	0.95	0.64
Oct. 19	do	.75	.09

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 45 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					11		0.81		0.72	21	0.74			0.80
2		0.85		0.71	12				.71	22	.80	0.71		.75
3				.71	13				.82	23	.90			.74
4				.72	14				.95	24	.90			.71
5		.88		.74	15			0.90	1.12	25			0.89	1.05
6				.71	16			.82	.81	26	.96	.71	.78	.98
7		.82		.70	17		.85		1.05	27	.91	.70	.75	1.00
8				.71	18				1.11	28	.90		.74	.95
9			0.86	.74	19	0.80	.75		1.08	29	.85		.72	1.05
10		.88	.78	.71	20				.98	30		.70	.72	
										31		.70		

Discharge measurements at station No. 46 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 26	C. H. Pierce	2.15	43.6
Oct. 19	do	1.56	7.2
22	do	1.45	3.35

NOTE.—This station is on Awehi Stream, which is tributary to Wailuku River.

Daily gage height, in feet, at station No. 46 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	1.85	.....	1.50	21	1.67	.....	3.70	2.25
2	.....	2.20	.....	1.46	12	.....	.....	.....	1.42	22	1.72	1.45	3.58	1.95
3	.....	.....	.....	1.41	13	.....	.....	.....	2.10	23	2.55	.....	3.64	1.80
4	.....	.....	.....	1.38	14	.....	.....	.....	2.35	24	2.60	.....	3.42	1.75
5	.....	2.38	.....	1.40	15	.....	.....	2.50	3.18	25	2.45	.....	2.34	2.25
6	.....	.....	.....	1.39	16	.....	.....	1.82	2.75	26	2.42	1.38	1.90	2.00
7	.....	2.08	.....	1.32	17	.....	1.90	.....	3.20	27	2.31	1.30	1.72	1.98
8	.....	.....	.....	1.34	18	.....	.....	.....	3.32	28	2.35	.....	1.62	1.90
9	.....	.....	2.14	1.52	19	1.85	1.56	.....	2.88	29	2.10	.....	1.48	2.12
10	.....	2.00	1.78	1.45	20	.....	.....	.....	2.75	30	.....	1.21	1.40	.....
										31	.....	1.24	.....	.....

Discharge measurements at station No. 47 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 26	C. H. Pierce	2.56	11.2
Oct. 19	do	1.96	2.75
22	do	1.50	1.57

NOTE.—This station is on Waiakaulupala Stream, which is tributary to Wailuku River.

Daily gage height, in feet, at station No. 47 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	2.38	.....	1.52	21	2.15	.....	3.55	2.50
2	.....	2.50	.....	1.45	12	.....	.....	.....	1.45	22	2.25	1.50	3.40	2.30
3	.....	.....	.....	1.32	13	.....	.....	.....	2.70	23	2.80	.....	3.52	2.20
4	.....	.....	.....	1.30	14	.....	.....	.....	3.00	24	2.75	.....	3.25	2.00
5	.....	2.68	.....	1.41	15	.....	.....	2.70	3.50	25	2.70	.....	2.65	2.50
6	.....	.....	.....	1.32	16	.....	.....	2.20	2.80	26	2.52	1.28	2.30	2.10
7	.....	2.52	.....	1.22	17	.....	2.48	.....	3.20	27	2.60	1.18	2.12	2.08
8	.....	.....	.....	1.28	18	.....	.....	.....	3.45	28	2.75	.....	2.02	1.95
9	.....	.....	2.50	1.62	19	2.35	1.96	.....	2.98	29	2.55	.....	1.85	2.25
10	.....	2.55	2.22	1.55	20	.....	.....	.....	2.90	30	.....	.95	1.68	.....
										31	.....	.92	.....	.....

Discharge measurements at station No. 48 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 21	C. H. Pierce	0.45	0.08
25	do	.72	1.26
Oct. 19	do	.55	.30

NOTE.—This stream is tributary to Wailuku River.

Daily gage height, in feet, at station No. 48 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	0.68	.....	0.78	21	0.45	.....	1.36	0.72
2	.....	0.68	.....	0.46	12	.....	.....	.....	.65	22	.55	0.50	1.30	.52
3	.....	.....	.....	.44	13	.....	.....	.....	.92	23	.70	.....	1.42	.52
4	.....	.....	.....	.45	14	.....	.....	.....	1.15	24	.68	.....	1.38	.51
5	.....	.75	.....	.46	15	.....	.....	0.82	1.38	25	.72	.....	.82	.82
6	.....	.....	.....	.50	16	.....	.....	.71	.85	26	.78	.54	.60	.75
7	.....	.72	.....	.48	17	.....	.75	.....	1.20	27	.70	.49	.58	.80
8	.....	.....	.....	.50	18	.....	.....	.....	1.25	28	.82	.....	.58	.75
9	.....	.....	0.71	.95	19	0.52	.55	.....	1.12	29	.68	.....	.55	.92
10	.....	.75	.62	.75	20	.....	.....	.....	.92	30	.....	.49	.54	.....
										31	.....	.48	.....	.....

Discharge measurements at station No. 49 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 21	C. H. Pierce	0.35	[a] 0.01
25[b]	do	.32	.23
Oct. 19	do	.05	[a].01

[a] Estimated. [b] Change in channel since previous measurement.

NOTE.—This stream is tributary to Maili Stream.

Daily gage height, in feet, at station No. 49 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	11	.....	0.10	.....	0.10	21	0.35	.....	0.46	0.20
2	.....	0.22	.....	0.01	12	.....	.....	.....	.02	22	[a].30	0.02	.42	.12
3	.....	.....	.....	.00	13	.....	.....	.....	.25	23	.30	.....	.45	.10
4	.....	.....	.....	.00	14	.....	.....	.....	.38	24	.30	.....	.41	.05
5	.....	.....	.....	.01	15	.....	.....	0.15	.45	25	.32	.....	.15	.21
6	.....	.....	.....	.02	16	.....	.....	.16	.32	26	.36	.02	.04	.15
7	.....	.....	.....	.01	17	.....	.15	.....	.38	27	.32	.02	.02	.20
8	.....	.....	.....	.04	18	0.55	.....	.....	.39	28	.35	.....	.04	.10
9	.....	(a)	0.30	.18	19	.39	.05	.....	.34	29	.20	.....	.02	.25
10	.....	.15	.10	.08	20	.....	.....	.....	.40	30	.....	.02	.02	.....
										31	.....	.02	.....	.....

[a] Stream bed changed.

Discharge measurements at station No. 50 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 21	C. H. Pierce	0.70	0.07
25	....do	.90	.89
Oct. 19	....do	.50	.03

NOTE.—This station is on Maili Stream, which joins Honolii River at sea level.

Daily gage height, in feet, at station No. 50 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[A. Bomin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	0.40	0.48	11	.....	0.70	0.59	0.58	21	0.66	0.47	1.31	0.60
2	.....	0.65	.40	.46	12	.....	.62	.56	.54	22	1.05	.47	1.38	.55
3	.....	1.10	.56	.39	13	0.78	.62	.76	.90	23	.91	.48	1.45	.40
4	.....	1.28	.62	.42	14	.78	.50	.66	.82	24	1.01	.46	1.25	.40
5	.....	.82	.58	.46	15	.96	.78	.90	1.40	25	.81	.46	.92	.65
6	.....	.81	.72	.45	16	.84	.62	.66	1.12	26	.91	.47	.62	.42
7	.....	.93	.69	.46	17	.74	.78	.86	1.04	27	.85	.46	.59	.64
8	.....	.89	.69	.50	18	.95	.64	.71	1.00	28	.92	.48	.61	.45
9	.....	.85	.72	.70	19	.78	.50	.98	1.00	29	.72	.46	.60	.59
10	.....	.80	.61	.60	20	.72	.48	.69	.98	30	.90	.40	.51	.42
										31	.....	.40	.....	.44

Discharge measurements at station No. 51 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec. ft.*
Oct. 7	C. H. Pierce	1.15	0.93
19	....do	.80	.06

Daily gage height, in feet, at station No. 51 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.82	21	.....	1.69	0.90
2	0.92	.....	0.79	12	.....	0.85	.....	22	.....	1.62	.82
3	1.20	.....	.72	13	.....	.98	.....	23	.....	1.80	.82
4	1.30	.....	.75	14	0.80	.88	1.64	24	.....	1.62	.90
5	.....	.....	.78	15	.....	.....	1.80	25	.....	1.08	.85
6	.....	0.90	.79	16	.....	.90	1.25	26	.....	.82	.82
7	1.15	.92	.78	17	.....	.....	1.35	27	0.79	.80	.81
8	.....	.97	.85	18	.....	.94	1.28	28	.....	.82	.81
9	.92	.....	.92	19	.80	.....	1.40	29	.....	.78	.85
10	.89	.....	.85	20	.....	1.00	1.40	30	.....	.79	.....
								31	.78	.....	.....

Discharge measurements at station No. 52 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 7	C. H. Pierce	1.75	114
19	do	.88	10.9
21	do	.74	10.0

NOTE.—This station is on the south fork of Honolii River.

Daily gage height, in feet, at station No. 52 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				11			0.75	21	0.74	4.15	1.64
2	1.88		0.81	12		0.91		22		3.38	1.00
3	1.79		.79	13		1.14		23		3.50	.95
4	2.60		.60	14	0.91	1.09	3.45	24		3.28	1.64
5			.61	15			4.50	25		2.00	1.45
6		1.54	.61	16		1.22	2.20	26		1.50	1.40
7	1.75	2.05	.60	17			2.35	27	.52	1.12	1.10
8		1.68	.79	18		1.58	2.25	28		1.02	1.40
9	1.71		.91	19	.89		2.40	29		1.00	1.45
10	1.52		.79	20		2.05	2.40	30		.90	
								31	.44		

Discharge measurements at station No. 53 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.60	0.11
21	do	.45	.00

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 53 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				11			0.52	21	[a]0.45		0.80
2			(a)	12		0.51		22			.65
3	0.80		(a)	13		.66		23			.65
4			(a)	14	0.48	.56	.89	24			.80
5			(a)	15			.98	25		0.61	.75
6		0.60	(a)	16		.55	.85	26		.52	.74
7		.65	(a)	17			.90	27	(a)	.50	.72
8		.68	0.54	18		.60	.85	28		.49	.72
9	.62		.55	19	.50		.92	29		[a].45	.75
10	.59		.54	20		.64	.92	30		(a)	
								31	(a)		

[a] No flow.

Discharge measurements at station No. 54 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	1.05	5.7
21	do	.75	.66

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 54 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				11			0.70	21	0.75		1.00
2			0.65	12		0.82		22			.85
3	1.50		.66	13		1.01		23			.85
4			.62	14	0.78	.90	1.30	24			1.00
5			.65	15			1.60	25		1.05	1.00
6		1.04	.65	16		.90	1.32	26		.90	.98
7		1.10	.66	17			1.35	27	.68	.82	.98
8		1.13	.72	18		.99	1.32	28		.80	.95
9	1.06		.74	19	.80		1.38	29		.78	1.00
10	1.00		.72	20		1.10	1.38	30		.70	
								31	.60		

Discharge measurements at station No. 55 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	1.30	2.20
21	do	1.05	.19

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 55 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				11			1.10	21	1.05		0.98
2			0.98	12		1.14		22			.98
3	1.60		.99	13		1.29		23			.95
4			.98	14	1.10	1.22	1.50	24			.90
5			1.00	15			1.70	25		1.24	.90
6		1.27	1.01	16		1.22	1.00	26		1.18	.88
7		1.35	1.00	17			1.05	27	.95	1.12	.88
8		1.39	1.14	18		1.28	1.02	28		1.11	.88
9	1.31		1.18	19	1.10		1.08	29		1.10	.90
10	1.28		1.14	20		1.38	1.08	30		1.08	
								31	.92		

Discharge measurements at station No. 56 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.62	0.03
21	.....do	.54	.00

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 56 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	(a)	21	a0.54	.....	0.65
2	.....	.....	(a)	12	.....	0.56	.....	22	.....	.....	.62
3	.....	.....	(a)	13	.....	.69	.....	23	.....	.....	.60
4	.....	.....	(a)	14	0.50	.62	0.80	24	.....	.....	.65
5	.....	.....	(a)	15	.....	.....	1.18	25	.....	0.62	.55
6	.....	0.65	(a)	16	.....	.61	.78	26	.....	(a)	.55
7	.....	.70	(a)	17	.....	.....	.82	27	(a)	(a)	(a)
8	.....	.71	(a)	18	.....	.65	.79	28	.....	(a)	(a)
9	0.64	.....	(a)	19	.55	.....	.82	29	.....	(a)	.55
10	.61	.....	(a)	20	.....	.68	.82	30	.....	(a)	.....
								31	(a)	.....	.....

a No flow.

Discharge measurements at station No. 57 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.98	0.36
21	.....do	.78	.05

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 57 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.79	21	0.78	.....	0.88
2	.....	.....	0.70	12	.....	0.82	.....	22	.....	.....	.85
3	.....	.....	.70	13	.....	.94	.....	23	.....	.....	.85
4	.....	.....	.70	14	0.80	.90	1.22	24	.....	.....	.84
5	.....	.....	.72	15	.....	.....	1.55	25	.....	0.99	.82
6	.....	0.91	.71	16	.....	.90	.98	26	.....	.81	.80
7	.....	1.00	.74	17	.....	.....	1.02	27	.72	.72	.78
8	.....	1.03	.81	18	.....	.94	.98	28	.....	.80	.78
9	0.94	.....	.85	19	.80	.....	1.02	29	.....	.79	.81
10	.95	.....	.81	20	.....	1.00	1.02	30	.....	.71	.....
								31	.70	.....	.....

Discharge measurements at station No. 58 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.85	0.60
21	.....do	.69	.09

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 58 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.66	21	0.69	.....	0.89
2	.....	.....	0.64	12	.....	0.71	.....	22	.....	.....	.85
3	.....	.....	.64	13	.....	.82	.....	23	.....	.....	.82
4	.....	.....	.62	14	0.71	.78	1.06	24	.....	.....	.84
5	.....	.....	.64	15	.....	.....	1.59	25	.....	0.80	.81
6	.....	0.80	.64	16	.....	.79	1.02	26	.....	.78	.80
7	.....	.88	.62	17	.....	.....	1.05	27	.65	.71	.80
8	.....	.92	.69	18	.....	.81	1.04	28	.....	.71	.80
9	0.85	.....	.71	19	.72	.....	1.05	29	.....	.70	.81
10	.82	.....	.69	20	.....	.88	1.05	30	.....	.69	.....
								31	.62	.....	.....

Discharge measurements at station No. 59 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.90	1.49
21	.....do	.65	.24

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 59 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Date.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.65	21	0.65	.....	0.88
2	.....	.....	0.64	12	.....	0.70	.....	22	.....	.....	.86
3	.....	.....	.60	13	.....	.86	.....	23	.....	.....	.86
4	.....	.....	.61	14	0.72	.80	.95	24	.....	.....	.82
5	.....	.....	.62	15	.....	.....	1.55	25	.....	0.85	.80
6	.....	0.83	.62	16	.....	.80	.99	26	.....	.74	.79
7	.....	.91	.61	17	.....	.....	1.02	27	.59	.72	.78
8	.....	1.00	.68	18	.....	.85	.94	28	.....	.71	.78
9	.....	.....	.70	19	.70	.....	1.02	29	.....	.68	.82
10	0.89	.....	.68	20	.....	.91	1.02	30	.....	.65	.....
								31	.54	.....	.....

Discharge measurements at station No. 60 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.65	0.26
21	do	.50	a.01

a Estimated.

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 60 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				11			0.48	21	0.50		0.88
2			a 0.40	12		0.60		22			.86
3			a.40	13		.65		23			.72
4			.41	14	0.52	.63	.88	24			.84
5			.42	15			1.44	25		0.72	.79
6		0.64	.42	16		.61	1.00	26		.61	.71
7		.70	.41	17			1.05	27	a.40	.52	.68
8		.73	.50	18		.61	1.00	28		.52	.68
9			.54	19	.53		1.05	29		.50	.72
10	0.65		.50	20		.78	1.05	30		.44	
								31	(a)		

a No flow.

Discharge measurements at station No. 61 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.45	0.08
21	do	.38	a.01

a Estimated.

NOTE.—This stream is tributary to Honolii River.

Daily gage height, in feet, at station No. 61 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				11			0.39	21	0.38		0.82
2			0.35	12		0.40		22			.72
3			.36	13		.51		23			.68
4			.34	14	0.40	.50	.79	24			.82
5			.35	15			1.00	25		0.44	.72
6		0.42	.35	16		.41	.82	26		.42	.70
7		.50	.34	17			.92	27	.35	.40	.70
8		.51	.40	18		.42	.84	28		.40	.70
9			.45	19	.40		.92	29		.38	.72
10	0.45		.40	20		.49	.92	30		.39	
								31	.38		

a No flow.

Discharge measurements at station No. 62 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	C. H. Pierce	1.58	18.7
21	.....do	1.12	2.76

NOTE.—This station is on the Pohakupaa Stream, which is the north fork of Honolii River.

Daily gage height, in feet, at station No. 62 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	1.08	21	1.12	.....	1.75
2	.....	.....	1.02	12	.....	1.25	.....	22	.....	.....	1.20
3	.....	.....	1.00	13	.....	1.52	.....	23	.....	.....	1.20
4	.....	.....	1.00	14	1.20	1.48	1.98	24	.....	.....	1.75
5	.....	.....	1.00	15	.....	.....	2.80	25	.....	1.70	1.52
6	.....	1.62	1.01	16	.....	1.40	1.95	26	.....	1.50	1.40
7	.....	1.82	1.02	17	.....	.....	2.15	27	1.00	1.42	1.30
8	.....	2.06	1.11	18	.....	1.55	1.98	28	.....	1.20	1.28
9	.....	.....	1.20	19	1.22	.....	2.18	29	.....	1.14	1.52
10	1.54	.....	1.11	20	.....	1 82	2.19	30	.....	1.02	.....
								31	.90	.....	.....

Discharge measurements at station No. 63 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet	*Sec.-ft.*
Oct. 10	C. H. Pierce	0.58	0.20
21	.....do	.52	.02

Daily gage height, in feet, at station No. 63 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.55	21	0.52	.....	0.90
2	.....	.....	0.51	12	.....	0.52	.....	22	.....	.....	.86
3	.....	.....	.50	13	.....	.61	.....	23	.....	.....	.69
4	.....	.....	.51	14	0.53	.59	.84	24	.....	.....	.90
5	.....	.....	.52	15	.....	.....	1.40	25	.....	0.58	.74
6	.....	0.56	.52	16	.....	.55	.92	26	.....	.54	.70
7	.....	.60	.51	17	.....	.....	1.00	27	.50	.51	.68
8	.....	.63	.59	18	.....	.58	.92	28	.....	.54	.68
9	.....	.....	.61	19	.52	.....	1.00	29	.....	.52	74
10	0.58	.....	59	20	.....	.60	1.02	30	.....	.51	.....
								31	.51	.....	.....

Daily measurements at station No. 64 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.		Hydrographer.	Gage height.	Discharge.
			Feet.	*Sec.-ft.*
Oct.	10	C. H. Pierce	0.50	0.16
	21	.....do	.45	.05

Daily gage height, in feet, at station No. 64 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.48	21	0.45	.....	0.85
2	.....	.....	0.45	12	.....	0.48	.....	22	.....	.....	.85
3	.....	.....	.45	13	.....	.51	.....	23	.....	.....	.78
4	.....	.....	.45	14	0.43	.52	.82	24	.....	.....	.85
5	.....	.....	.45	15	.....	.....	1.32	25	.....	0.50	.72
6	.....	0.51	.44	16	.....	.50	.88	26	.....	.49	.68
7	.....	.51	.45	17	.....	.....	.92	27	.48	.45	.65
8	.....	.54	.50	18	.....	.50	.88	28	.....	.46	.65
9	.....	.....	.54	19	.45	.....	.92	29	.....	.46	.72
10	0.50	.....	.50	20	.....	.51	.94	30	.....	.45	.....
								31	.44	.....	.....

Discharge measurements at station No. 65 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.		Hydrographer.	Gage height.	Discharge.
			Feet.	*Sec.-ft.*
Oct.	10	C. H. Pierce	1.62	0.53
	21	.....do	1.55	.18

Daily gage height, in feet, at station No. 65 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	1.55	21	1.55	.....	1.65
2	.....	.....	1.50	12	.....	1.58	.....	22	.....	.....	1.55
3	.....	.....	1.50	13	.....	1.68	.....	23	.....	.....	1.55
4	.....	.....	1.50	14	1.52	1.64	1.98	24	.....	.....	1.65
5	.....	.....	1.50	15	.....	.....	2.29	25	.....	1.59	1.50
6	.....	1.61	1.52	16	.....	1.60	1.80	26	.....	1.51	1.50
7	.....	1.68	1.51	17	.....	.....	1.88	27	1.55	1.51	1.50
8	.....	1.74	1.59	18	.....	1.62	1.82	28	.....	1.50	1.50
9	.....	.....	1.62	19	1.55	.....	1.88	29	.....	1.50	1.54
10	1.62	.....	1.59	20	.....	1.65	1.89	30	.....	1.51	.....
								31	1.51	.....	.....

Discharge measurements at station No. 66 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21	C. H. Pierce	0.50	0.02

Daily gage height, in feet, at station No. 66 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.45	21	0.50	.....	0.84
2	.....	.....	0.45	12	.....	0.52	.....	22	.....	.....	.80
3	.....	.....	.45	13	.....	.69	.....	23	.....	.....	.78
4	.....	.....	.46	14	.....	.64	.75	24	.....	.....	.85
5	.....	.....	.45	15	.....	.....	1.20	25	.....	0.61	.70
6	.....	0.61	.45	16	.....	.61	.88	26	.....	.52	.68
7	.....	.68	.45	17	.....	.....	.92	27	.48	.50	.62
8	.....	.70	.48	18	.....	.64	.88	28	.....	.50	.62
9	.....	.....	.51	19	.....	.....	.92	29	.....	.48	.70
10	.....	.....	.48	20	.....	.64	.95	30	.....	.48	.....
								31	.45	.....	.....

Discharge measurements at station No. 67 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage. height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21	C. H. Pierce	0.40	0.14

Daily gage height, in feet, at station No.67 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	0.40	21	0.40	.....	0.90
2	.....	.....	0.39	12	.....	0.48	.....	22	.....	.....	.80
3	.....	.....	.39	13	.....	.60	.....	23	.....	.....	.74
4	.....	.....	.39	14	.....	.56	.82	24	.....	.....	.90
5	.....	.....	.38	15	.....	.....	1.35	25	.....	0.51	.80
6	.....	0.54	.38	16	.....	.51	.92	26	.....	.45	.80
7	.....	.60	.39	17	.....	.....	1.00	27	.40	.40	.78
8	.....	.58	.41	18	.....	.54	.92	28	.....	.41	.78
9	.....	.....	.45	19	.....	.....	1.02	29	.....	.40	.80
10	.....	.....	.41	20	.....	.55	1.05	30	.....	.38	.....
								31	.40	.....	.....

Discharge measurements at station No. 68 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21	C. H. Pierce	1.00	4.61

NOTE.—This station is on the Waipahoehoe Stream.

Daily gage height, in feet, at station No. 68 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov	Dec.
1				11			0.81	21	1.00		1.85
2			1.05	12		1.30		22			1.20
3			.91	13		1.84		23			1.00
4			.78	14		1.75	2.88	24			1.85
5			.81	15			3.19	25		2.02	1.52
6		1.81	.82	16		1.60	2.05	26		1.62	1.42
7		2.04	.82	17			2.25	27	.81	1.14	1.40
8		2.22	.85	18		1.88	2.15	28		1.15	1.40
9		1.95	.89	19			2.25	29		1.10	1.52
10		1.70	.85	20		2.10	2.39	30		1.09	
								31	.65		

Discharge measurements at station No. 69 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 13	C. H. Pierce	1.00	6.6

Daily gage height, in feet, at station No. 69 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.74	21		1.25
2		0.74	12			22		1.02
3		.72	13	1.00		23		1.00
4		.72	14	.95	1.32	24		1.25
5		.72	15		1.70	25	0.98	1.10
6		.72	16	.90	1.44	26	.82	1.05
7		.72	17		1.50	27	.80	1.00
8		.78	18	.98	1.45	28	.81	1.00
9		.81	19		1.50	29	.78	1.10
10		.78	20	1.05	1.55	30	.74	
						31		

Discharge measurements at station No. 70 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 13	C. H. Pierce	1.01	1.78

Daily gage height, in feet, at station No. 70 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.82	21		0.92
2		0.89	12			22		.85
3		.84	13	1.01		23		.86
4		.80	14	1.01	1.04	24		.92
5		.80	15		1.64	25	1.09	.86
6		.81	16	.98	1.22	26	.95	.86
7		.81	17		1.25	27	.92	.80
8		.86	18	1.01	1.24	28	.94	.80
9		.89	19		1.25	29	.92	.86
10		.86	20	1.10	1.25	30	.90	
						31		

Discharge measurements at station No. 71 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 13	C. H. Pierce	0.74	0.11

Daily gage height, in feet, at station No. 71 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.65	21		0.90
2		0.64	12			22		.86
3		.64	13	0.74		23		.86
4		.64	14	.71	.95	24		.90
5		.65	15		1.36	25	0.71	.85
6		.65	16	.70	.94	26	.69	.85
7		.66	17		1.00	27	.65	.84
8		.69	18	.70	.94	28	.69	.84
9		.75	19		1.02	29	.66	.85
10		.69	20	.72	1.04	30	.64	
						31		

Discharge measurements at station No. 72 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 13	C. H. Pierce	1.05	0.14

Daily gage height, in feet, at station No. 72 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		1.00	21		1.16
2		0.98	12			22		1.00
3		.95	13	1.05		23		1.00
4		.94	14	1.01	1.32	24		1.10
5		1.00	15		1.70	25	1.00	1.00
6		1.00	16	1.01	1.38	26	.98	1.00
7		.99	17		1.40	27	.99	.98
8		1.02	18	1.05	1.38	28	1.00	.98
9		1.08	19		1.40	29	.98	1.00
10		1.02	20	1.09	1.45	30	.91	
						31		

Discharge measurements at station No. 73 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 13	C. H. Pierce	1.00	1.19

Daily gage height, in feet, at station No. 73 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.65	21		0.94
2		0.65	12			22		.88
3		.66	13	1.00		23		.84
4		.66	14	.92	1.00	24		.94
5		.66	15		1.55	25	0.98	.85
6		.66	16	.88	1.12	26	.80	.81
7		.65	17		1.20	27	.70	.81
8		.68	18	.95	1.12	28	.70	.81
9		.70	19		1.22	29	.69	.85
10		.68	20	1.00	1.25	30	.68	
						31		

Discharge measurements at station No. 74 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 13	C. H. Pierce	2.18	22.0

NOTE.—This stream is probably the one that is known at the public road near the sea as Kapue or Papaikou Stream.

Daily gage height, in feet, at station No. 74 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		1.62	21		2.00
2		1.64	12			22		1.65
3		1.62	13	2.18		23		1.64
4		1.60	14	2.11	2.78	24		2.00
5		1.62	15		3.55	25	2.34	1.80
6		1.62	16	2.18	2.38	26	2.00	1.60
7		1.62	17		2.45	27	1.98	1.50
8		1.69	18	2.32	2.38	28	1.90	1.50
9		1.72	19	3.40	2.48	29	1.70	1.80
10		1.69	20	2.52	2.55	30	1.69	
						31		

Discharge measurements at station No. 75 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	1.00	0.73

Daily gage height, in feet, at station No. 75 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.91	21		0.90
2		0.88	12			22		.88
3		.88	13			23		.88
4		.88	14	1.02	1.39	24		.90
5		.90	15		1.52	25	1.09	.90
6		.91	16	1.00	1.20	26	.98	.90
7		.92	17		1.25	27	.94	.85
8		.95	18	1.05	1.22	28	.94	.85
9		1.00	19	1.28	1.25	29	.90	.90
10		.95	20	1.10	1.30	30	.88	
						31		

Discharge measurements at station No. 76 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	0.98	1.70

Daily gage height, in feet, at station No. 76 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.80	21		1.00
2		0.78	12			22		.90
3		.78	13			23		.88
4		.78	14	1.01	1.22	24		1.00
5		.81	15		1.48	25	1.10	.95
6		.81	16	1.00	1.15	26	.99	.90
7		.82	17		1.20	27	.89	.90
8		.86	18	1.05	1.15	28	.89	.90
9		.89	19	1.60	1.24	29	.82	.95
10		.86	20	1.19	1.32	30	.80	
						31		

Discharge measurements at station No. 77 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	0.80	0.50

Daily gage height, in feet, at station No. 77 at elevation 2,500 feet, near, Hilo Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.92	21		1.14
2		0.98	12			22		1.00
3		.96	13			23		1.00
4		.90	14	0.80	1.46	24		1.10
5		.94	15		1.61	25	1.14	1.05
6		.94	16	.75	1.30	26	1.12	1.02
7		.95	17		1.35	27	1.10	1.00
8		.94	18	.95	1.34	28	1.12	1.00
9		.94	19	1.25	1.38	29	1.09	1.05
10		.94	20	.95	1.45	30	1.01	
						31		

Discharge measurements at station No. 78 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	0.98	0.44

Daily gage height, in feet, at station No. 78 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.82	21		0.98
2		0.85	12			22		.85
3		.86	13			23		.85
4		.86	14	1.00	1.26	24		.94
5		.84	15		1.45	25	1.08	.90
6		.84	16	.95	1.00	26	.88	.90
7		.85	17		1.15	27	.89	.90
8		.88	18	1.02	1.00	28	.89	.90
9		.89	19	1.22	1.15	29	.89	.94
10		.85	20	1.02	1.25	30	.85	
						31		

Discharge measurements at station No. 79 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	1.00	0.58

Daily gage height, in feet, at station No. 79 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.81	21		1.02
2		0.80	12			22		.90
3		.79	13			23		.88
4		.75	14	1.02	1.30	24		1.00
5		.80	15		1.55	25	1.50	.98
6		.81	16	1.05	1.14	26	1.35	.90
7		.82	17		1.26	27	.90	.90
8		.86	18	1.15	1.14	28	.90	.90
9		.88	19	2.10	1.26	29	.88	.98
10		.86	20	1.52	1.35	30	.82	
						31		

Discharge measurements at station No. 80 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	1.20	1.70

Daily gage height, in feet, at station No. 80 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.90	21		1.12
2		0.98	12			22		1.00
3		.94	13			23		1.00
4		.90	14	1.22	1.42	24		1.12
5		.91	15		1.65	25	1.49	1.05
6		.91	16	1.25	1.22	26	1.24	1.02
7		.92	17		1.35	27	1.12	1.00
8		.95	18	1.35	1.22	28	1.12	1.00
9		.99	19	1.90	1.38	29	1.18	1.05
10		.95	20	1.51	1.45	30	1.10	
						31		

Discharge measurements at station No. 81 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	1.00	9.9

NOTE.—This stream is probably the one that is known at the public road near the sea as Hanawai Stream.

Daily gage height, in feet, at station No. 81 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.71	21		0.90
2		0.78	12			22		.85
3		.76	13			23		.80
4		.65	14	1.00	1.32	24		.90
5		.68	15	1.38	1.55	25	1.40	.88
6		.68	16	1.01	1.16	26	1.25	.85
7		.69	17		1.28	27	.90	.84
8		.74	18	1.31	1.16	28	.90	.84
9		.78	19	2.10	1.28	29	.89	.82
10		.74	20	1.42	1.36	30	.81	
						31		

Discharge measurements at station No. 82 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	0.80	0.11

Daily gage height, in feet, at station No. 82 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.61	21		0.92
2		0.61	12			22		.86
3		.60	13			23		.80
4		.60	14	0.80	.94	24		.92
5		.62	15	.82	1.25	25	0.90	.90
6		.60	16		.96	26	.81	.85
7		.61	17	.82	1.05	27	.61	.85
8		.64	18	1.08	.96	28	.61	.85
9		.68	19	.92	1.05	29	.61	.90
10		.64	20		1.15	30	.61	
						31		

Discharge measurements at station No. 83 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	1.00	0.03

Daily gage height, in feet, at station No. 83 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.90	21		1.20
2		0.90	12			22		.90
3		.90	13			23		.90
4		.90	14	1.00	1.46	24		1.20
5		.92	15	1.04	1.64	25	1.09	1.15
6		.90	16		1.32	26	.92	1.10
7		.91	17		1.45	27	.92	1.08
8		.96	18	1.08	1.32	28	.91	1.08
9		.95	19	1.20	1.45	29	.91	1.15
0		.96	20	1.10	1.55	30	.91	
						31		

Discharge measurements at station No. 84 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	0.50	0.28

Daily gage height, in feet, at station No. 84 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.29	21		0.78
2		0.30	12			22		.70
3		.30	13			23		.60
4		.25	14	0.50	.65	24		.72
5		.25	15	.45	.79	25	0.51	.70
6		.25	16		.70	26	.49	.70
7		.25	17		.75	27	.31	.68
8		.30	18	.52	.78	28	.31	.68
9		.32	19	.60	.79	29	.31	.70
10		.30	20	.55	.85	30	.30	
						31		

Discharge measurements at station No. 85 at elevation 2,500 feet, near Hilo, Hawaii, in 1911

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	0.90	3.2

Daily gage height, in feet, at station No. 85 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.75	21		0.8
2		0.74	12			22		.8
3		.74	13			23		.7
4		.74	14	0.90	.99	24		.8
5		.76	15	.98	1.36	25	1.39	.8
6		.76	16		.92	26	1.20	.8
7		.75	17		1.02	27	.80	.8
8		.78	18	1.02	.92	28	.80	.8
9		.81	19	1.60	1.02	29	.79	.8
10		.78	20	1.42	1.16	30	.74	
						31		

Discharge measurements at station No. 86 at elevation 2,500 feet, near Hilo, Hawaii, in 1911

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	1.70	7.

NOTE.—This station is on the principal tributary of Kawainui River.

Daily gage height, in feet, at station No. 86 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		1.54	21		1.68
2		1.55	12			22		1.55
3		1.54	13			23		1.55
4		1.52	14	1.70	2.75	24		1.01
5		1.52	15	1.92	3.58	25	1.85	1.00
6		1.52	16		2.36	26	1.74	.95
7		1.51	17		2.50	27	1.65	.95
8		1.59	18	1.82	2.45	28	1.65	.95
9		1.62	19	2.30	2.55	29	1.66	1.00
10		1.59	20	1.82	2.68	30	1.62	
						31		

Discharge measurements at station No. 87 at elevation 2,500 feet, near Hilo, Hawaii, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 14	C. H. Pierce	1.35	3.36

NOTE.—This station is on the north fork of Kawainui River.

Daily gage height, in feet, at station No. 87 at elevation 2,500 feet, near Hilo, Hawaii, for 1911.

[C. Bilkov, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		0.98	21		1.05
2		0.95	12			22		.98
3		.95	13			23		.95
4		.95	14	1.35	1.70	24		1.58
5		.99	15	1.54	2.15	25	1.59	1.55
6		.99	16		1.50	26	1.32	1.50
7		.98	17		1.62	27	1.12	1.50
8		1.00	18	1.52	1.52	28	1.12	1.50
9		1.05	19	2.25	1.66	29	1.00	1.55
0		1.00	20	1.62	1.95	30	.99	
						31		

MISCELLANEOUS MEASUREMENTS.

MEASUREMENTS AT ELEVATION 1,800 TO 2,000 FEET IN THE FOREST BACK OF HILO, HAWAII.

A trail was cut through the forest at elevation approximately 2,000 feet from Waipahoehoe Stream on the north to Kapehu Stream on the south. Miscellaneous measurements were made on some of these streams. For the purpose of these measurements the streams are considered in order southward, and those between the Maili and Awehi are numbered consecutively. These numbers have no connection with the numbers of the stations at elevation 2,500 feet.

Miscellaneous measurements at elevation 1,800 to 2,000 feet, near Hilo, Hawaii, in 1911.

Date.	Stream.	Tributary to—	Reference point.[a]	Discharge.
			Feet.	*Sec.-ft.*
May 5	Uhakauwai	Maili Stream	2.15	5.4
20	do	do	2.18	5.1
Apr. 30	Maili	Honolii Bay	1.48	11.7
May 20	do	do	1.54	8.9
Apr. 30	No. 1, south of Maili			0.44
May 20	do			0.20
Apr. 30	No. 2, south of Maili			0.72
May 20	do			0.90
Apr. 30	No. 3, south of Maili		2.80	3.51
May 20	do		2.90	2.63
Apr. 30	No. 4, south of Maili		3.71	3.63
May 20	do		3.75	2.30

[a] Distances measured to water surface from a fixed point above.

MEASUREMENTS FROM HILO TO LAUPAHOEHOE.

There are about 60 streams between Hilo and Laupahoehoe. During 1911 several sets of miscellaneous measurements were made on these streams along the public road near the coast. Some of the measurements were made at low periods and give a good indication of what may reasonably be expected as a minimum flow. The most important streams are those south of Hakalau.

Miscellaneous measurements of streams between Hilo and Laupahoehoe in 1911.

[Measurements made in vicinity of public road.]

Date.	Stream.	Reference point.[a]	Discharge.	Date.	Stream.	Reference point.[a]	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 16	Pukihae		54	Nov. 25	Kapue (or Papaikou)		[b] 250
Mar. 17	do	4.75	9.5	Feb. 18	Kaieie		7.5
20	do	4.32	46.0	Mar. 23	do	3.64	6.8
Apr. 15	do	4.54	22.9	Nov. 25	do	3.37	26.9
Nov. 24	do	3.4	[b] 200	25	Ditch, diversion from Kaieie Stream		1.6
Feb. 17	Pohakunanaka		10.0	Feb. 18	Aleamai		22.2
Mar. 17	do	3.45	3.7	Mar. 23	do	4.12	11.1
20	do	3.12	19.3	Nov. 15	do	3.43	47.5
Apr. 15	do	3.34	7.2	Feb. 20	Kalaoa (Puu Moi)		4.6
Nov. 24	do	2.9	[b] 40	Mar. 23	do	2.25	6.3
Feb. 17	Maili		40.0	Nov. 25	do	1.62	24.1
Mar. 20	do	3.60	[c] 40.8	Feb. 20	Hanawai		40.3
Apr. 19	do	3.43	39.0	Mar. 23	do	3.05	41.0
Nov. 24	do		[b] 150	Nov. 25	do		[b] 150
Feb. 17	Kikola		7.5	25	Onomea		[b] 25
Mar. 20	do	2.85	18.3	Feb. 21	Kawainui [d]		56
Apr. 19	do	3.42	7.4	21	Waiaama		22.5
Nov. 24	do	2.8	[b] 25	Mar. 24	do	3.92	30.1
Feb. 17	Honolii		[b] 250	Nov. 28	do		24.0
Mar. 20	do	3.30	101	Feb. 21	Pepeekeo		5.9
Nov. 24	do		[b] 500	Mar. 24	do	4.55	2.6
Feb. 20	Kumunuiakea		4.4	Nov. 28	do	4.33	6.0
Mar. 20	do		7.9	Feb. 21	Kapeha		2.6
Nov. 25	do	4.96	22.4	Mar. 24	do	4.28	4.8
Feb. 18	Waipahoehoe		[b] 100	Nov. 28	do	4.25	6.4
Mar. 22	do	5.03	35.4	Feb. 21	Makoewai		11.9
Nov. 25	do		[b] 200	Mar. 24	do	3.68	7.8
25	Flume, diversion from Waipahoehoe Stream		3.9	Nov. 28	do	2.90	12.5
Feb. 18	Kapue (or Papaikou)		42.8	28	Flume, diversion from Makoewai Stream		3.7
Mar. 23	do	3.93	66				

[a] Distance measured to water surface from a fixed point above.
[b] Estimated, or partly estimated.
[c] Mean of two measurements.
[d] See measurements listed on p. 345.

Miscellaneous measurements of streams between Hilo and Laupahoehoe in 1911—Contd.

Date.	Stream.	Reference point.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 21	Makea		13.4
Mar. 24	do	0.98	11.9
Nov. 28	do	0.70	16.6
28	[No name]	2.7	3.1
Feb. 22	Honomu		9.1
Mar. 24	do	3.28	4.9
Dec. 2	do	2.78	19.8
Feb. 22	Kapahehe		9.1
Mar. 25	do	3.14	3.4
Dec. 2	do	2.80	10.5
Feb. 22	Kolekole		41.6
Mar. 25	do	2.89	26.6
Dec. 2	do	2.62	53.0
Feb. 25	Kaahakini		7.1
Mar. 25	do	2.26	4.2
Dec. 2	do	1.90	8.7
Feb. 27	Hakalau		45.6
Mar. 30	do	3.53	26.5
Dec. 5	do		48.2
Mar. 4	Haunapueo		[b]5.0
Apr. 10	do	3.40	6.9
Dec. 5	do	3.43	6.0
Mar. 4	Wailua		[a]50.0
Apr. 10	do	3.38	23.6
Dec. 6	do		17.7
Mar. 4	Eehui (Peleau)		5.7
Apr. 10	do	3.77	2.2
Dec. 6	do	3.83	0.6
Mar. 7	Opea		20.5
Apr. 10	do	1.96	9.8
Dec. 6	do	1.83	12.1
Mar. 7	Nanue		3.7
Apr. 9	do	1.41	4.1
Dec. 6	do	1.33	5.3
Mar. 7	Waiehu		5.0
Apr. 9	do	4.43	7.7
Dec. 6	do	4.45	4.2
Apr. 9	[Nameless]	1.08	1.0
Dec. 6	do		0.5
Mar. 7	Waikaumalo		4.4
Apr. 9	do	1.91	6.6
Dec. 6	do	2.00	8.2
Mar. 7	Waimalino		0.6
Apr. 9	do	2.38	1.1
Dec. 6	do	2.48	0.5
Mar. 7	Kaleiiki and Kapena (below confluence)		4.6
Apr. 9	do	1.08	2.8
Dec. 6	do	0.73	2.2
Mar. 7	Waikola		1.0
Apr. 9	do	2.08	1.0
Dec. 6	do		2.8
Mar. 7	Kaoheiki		0.7
29	do	2.57	2.5
Dec. 7	do	2.68	1.5
Mar. 8	Ninole		2.1
29	do	1.59	1.7
Dec. 7	do	1.62	0.7
Mar. 8	Puuohua		1.8
29	do	2.48	0.9
Dec. 7	do		1.3
Mar. 8	Manoloa		2.5
29	do	1.26	1.6
Dec. 7	Manoloa	1.95	1.4
Mar. 8	Poopoo		7.0
29	do	3.10	2.6
Dec. 7	do		3.2
Mar. 8	Kahina Pukii		1.0
29	do	2.18	0.2
Dec. 7	do		[a] 0.02
Mar. 2	Ahole		4.2
29	do	1.17	2.0
Dec. 7	do	2.95	0.5
Mar. 2	Papaa (Kulanakii)		6.8
29	do	1.34	2.5
Dec. 7	do		1.8
Mar. 2	Pohakupuka		7.0
29	do	2.65	4.1
Dec. 7	do		4.4
Mar. 2	Huliilii		0.0
2	Okole		0.0
2	Puu Olii		0.0
2	Maulua		5.2
27	do		0.0
28	do	1.90	2.8
Dec. 7	do		[a]1.0
Feb. 8	Koheaka		[b]300
Mar. 2	do		1.6
27	do		0.0
28	do	2.20	0.2
Dec. 7	do		0.0
Mar. 2	Weloka		2.5
28	do	1.51	1.5
Dec. 7	do		[a]0.5
Mar. 1	Keaalau		11.1
28	do	3.44	1.0
Dec. 8	do		6.0
Mar. 1	Kapehu		3.9
28	do		[a]0.1
Dec. 8	do		0.3
Mar. 1	Moanalulu		2.8
28	do	1.82	0.4
Dec. 8	do	1.93	0.2
Mar. 1	Papaaloa		4.8
28	do	1.49	0.7
Dec. 8	do		1.7
Mar. 1	Kihalani		3.5
28	do	2.92	0.2
Dec. 8	do		0.9
Mar. 1	Hokumahoe		3.1
28	do	3.02	0.8
Dec. 8	do		0.7
Mar. 1	Manowaiopae		5.3
28	do	2.57	0.9
Dec. 8	do		3.8
Mar. 1	Puu Alaea		6.0
28	do	1.62	0.6
Dec. 8	do		[a]0.5
Mar. 1	Kilau		2.0
28	do		0.1
Dec. 8	do		1.9
Mar. 3	Laupahoehoe		[a]1.0
3	do. [c]		[a]3.0
28	do		0.0
28	do. [c]		0.0
Dec. 7	do		0.0

[a] Estimated, or partly estimated.
[b] From estimates made by engineers of Hilo Railroad.
[c] Measurement of south fork one-half mile above public road.

OTHER STREAMS AND FLUMES.

Various miscellaneous measurements were made on other streams and flumes in the Hilo group. They are given below, being arranged in order from south to north so far as possible.

Miscellaneous measurements in Hilo group in 1911.

Date.	Stream.	Locality.	Discharge.
			Sec.-ft.
Nov. 21	Olaa flume	Kaumana road	16.8
21	Wainaku flume	do	2.9
20	Hilo water reservation	Punahoa	1.8
20	Mission water head	do	1.5

HAMAKUA GROUP OF STREAMS.

GENERAL FEATURES.

The Hamakua district lies along the eastern coast of Hawaii and includes portions of the northern slopes of Mauna Kea and the Kohala Mountains. That part of the district which properly belongs to the Mauna Kea slope has very few, if any, permanent streams. In the east end of the district there are a larger number of gulches, some of which carry streams for considerable periods after heavy rainfall, but are dry at other seasons.

On the Kohala slope there are numerous permanent streams, the largest and most important being Waipio River and its tributaries. Such of these streams as are not in the Kohala district make up the Hamakua group.

WAIPIO RIVER BASIN.

GENERAL FEATURES.

The Waipio River basin lies on the eastern slope of the Kohala Mountains. From its mouth near Waipio village it extends southward for 4 or 5 miles as a deep, broad canyon, thence westward toward the summit of the mountains. The walls of the canyon are very steep and are 1,000 to 2,000 feet high. The main stream, which is called Kawainui (the big water) in its upper course, has several tributaries entering from the south. These are Alakahi, Koiawe, and Waima. A large part of the water which originates in this basin appears as springs below elevation 1,000 feet. Two ditch systems have been built on the eastern slope of the Kohala Mountains, both of which are supplied from the Waipio streams.

The old or upper Hamakua ditch takes water from the various Waipio tributaries, beginning in Kawainui at elevation 4,042 feet, and after dropping down the streams at various points follows around nearly on the divide between Waimea and Kohala, finally delivering the water at elevation 2,934 feet. This ditch was originally intended for fluming only, but is now used partially for irrigation. Two reservoirs, one of 72,000,000 and one of 200,000,000 gallons capacity, have been built at elevation 3,000 feet. The lower ditch, known as the New Hamakua, heads in the main or Kawainui stream

at elevation 1,037 feet, and intercepts water from the three principal tributaries through side intakes. Although the ditch usually diverts all the water from the various streams at the intakes, large quantities appear at lower elevations.

Gaging stations have been established on the main stream above the ditch intake and at points below the confluence of the Koiawe and Waima streams.

KAWAINUI OF WAIPIO RIVER NEAR WAIPIO, HAWAII.

A gaging station was established on Kawainui River July 20, 1911, above the intake of the new Hamakua ditch about 5 miles from Waipio village and 1,037 feet above sea level. This station was put in by the Hawaiian Irrigation Co. under the direction of Jorgen Jorgensen, engineer.

A staff gage, graduated in tenths of feet, is fastened to the left bank and is used to obtain gage heights.

Low-water measurements are made by wading and high-water measurements are made from a footbridge about 10 feet below the gage. Not enough measurements have been made to rate the section, but daily gage heights have been obtained through the assistance of the Hawaiian Irrigation Co.

The discharge at this station gives the total flow of the main branch of Waipio River above the intake of the lower ditch.

Discharge measurements of Kawainui of Waipio River near Waipio, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 10	C. H. Pierce	26.5	39.0	1.15	28.8

Daily gage height, in feet, of Kawainui of Waipio River near Waipio, Hawaii, for 1911.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.65	1.90	2.20	1.28	1.35	16	.....	2.45	1.85	1.90	1.35	2.35
2	.....	1.80	2.00	2.05	1.30	1.30	17	.....	2.58	1.40	2.40	2.10	2.55
3	.....	1.55	2.15	2.25	1.30	1.30	18	.....	2.35	2.20	1.95	2.00	2.65
4	.....	1.50	2.20	2.50	1.35	1.20	19	.....	3.25	1.90	1.48	2.45	2.50
5	.....	1.40	2.00	2.25	1.50	1.20	20	2.35	2.05	2.00	1.40	1.70	2.15
6	.....	1.30	2.00	2.10	2.00	1.25	21	2.00	1.75	1.95	1.40	3.10	2.00
7	.....	1.40	2.20	2.30	1.55	1.35	22	2.40	1.35	2.60	1.40	6.25	1.70
8	.....	1.65	2.05	2.25	1.40	1.30	23	5.52	1.80	2.40	1.40	2.65	1.60
9	.....	1.80	2.20	1.98	1.35	1.20	24	1.82	2.70	2.35	1.30	2.50	1.40
0	.....	1.70	1.85	1.90	1.30	1.20	25	1.75	2.35	2.65	1.32	2.05	1.40
1	.....	1.70	3.00	1.85	1.22	1.20	26	1.70	2.20	2.30	1.30	1.55	1.35
2	.....	2.00	2.15	1.70	1.20	1.20	27	1.70	2.30	2.45	1.30	1.35	1.30
3	.....	2.60	1.95	1.60	1.65	2.50	28	1.70	2.25	2.60	1.30	1.90	1.30
4	.....	1.80	2.20	1.45	2.05	3.15	29	1.75	2.70	2.30	1.40	2.10	1.40
5	.....	2.25	2.30	1.75	2.30	3.60	30	1.80	2.50	3.30	1.30	1.70	1.40
							31	1.70	2.05	.....	1.30	.....	1.50

WAIPIO RIVER BELOW KOIAWE, NEAR WAIPIO, HAWAII.

A gaging station was established on Waipio River below its confluence with Koiawe Stream July 20, 1911. The station was established by the Hawaiian Irrigation Co. under the direction of Jorgen Jorgensen, engineer.

A staff gage, graduated in tenths of feet, is fastened to the left bank of the stream and is used to obtain gage heights.

Low-water measurements are made by wading and high-water measurements from a footbridge.

Not enough measurements have been made to rate the section, but daily gage heights have been obtained through the assistance of the Hawaiian Irrigation Co.

The discharge at this point gives the total flow of the stream exclusive of water taken by the two ditches above. Ordinarily the water appearing here comes from springs below the ditches.

Discharge measurements of Waipio River below Koiawe, near Waipio, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 10	C. H. Pierce	26.0	41.8	0.90	27.2

Daily gage height, in feet, of Waipio River below Koiawe, near Waipio, Hawaii, for 1911.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.15	1.10	2.00	0.92	1.00	16	.....	2.40	1.10	1.20	1.00	2.75
2	.....	1.10	1.50	1.60	1.05	.95	17	.....	2.30	.95	2.90	1.70	2.75
3	.....	1.10	1.30	1.80	.95	.92	18	.....	1.45	2.40	1.20	1.00	3.90
4	.....	1.10	2.10	3.00	1.05	.90	19	.....	3.10	1.42	1.00	2.80	3.50
5	.....	1.10	1.25	1.80	1.35	.90	20	2.20	1.10	1.65	.95	1.22	2.15
6	.....	1.10	1.20	1.40	1.30	.90	21	1.25	1.10	1.70	.95	3.70	1.35
7	.....	1.10	2.30	2.80	1.20	.90	22	2.30	1.10	2.30	.95	3.90	1.10
8	.....	1.10	2.30	2.15	1.20	.90	23	1.20	1.12	3.00	.95	3.30	1.05
9	.....	1.10	1.40	1.60	1.15	.90	24	1.15	3.30	2.30	.95	3.00	1.00
10	.....	1.10	1.15	1.18	1.00	.90	25	1.12	2.40	1.80	.95	1.80	.95
11	.....	1.10	3.50	1.70	.95	.90	26	1.10	1.40	2.90	.95	1.05	.90
12	.....	1.35	2.25	1.25	.92	.90	27	1.10	2.00	3.00	.95	.95	.90
13	.....	1.90	2.00	1.00	1.80	3.30	28	1.10	1.40	2.70	.95	2.70	.90
14	.....	1.10	1.65	.95	1.62	2.90	29	1.12	2.90	2.50	.95	2.80	.90
15	.....	1.70	1.25	.95	1.90	5.00	30	1.15	2.70	4.00	.95	1.10	.90
							31	1.10	2.20	.....	.92	.....	1.22

WAIPIO RIVER BELOW WAIMA, NEAR WAIPIO, HAWAII.

A gaging station was established on Waipio River about 400 feet below its confluence with Waima stream July 20, 1911. The station was put in by the Hawaiian Irrigation Co. under the direction of Jorgen Jorgensen, engineer.

A staff gage, graduated to tenths of a foot, is fastened to the south side of the stream and is used to obtain gage heights.

Low-water measurements are made by wading, and high-water measurements from a footbridge about 100 feet above the gage.

Not enough measurements have been made to rate the section, but daily gage heights have been obtained through the assistance of the Hawaiian Irrigation Co.

The discharge at this station gives the total flow of the stream below all main tributaries exclusive of the water taken by the two ditches above. Ordinarily the flow at this point represents water which originates from springs below the ditches.

Discharge measurements of Waipio River below Waima, near Waipio, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Dec. 10	C. H. Pierce	36.5	58.0	0.45	54.8

Daily gage height, in feet, of Waipio River below Waima, near Waipio, Hawaii, for 1911.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.55	0.60	0.92	0.50	0.50	16	.....	1.65	0.70	0.62	0.52	1.42
2	.....	.60	.75	.65	.52	.50	17	.....	1.20	.50	1.58	.55	1.52
3	.....	.58	.65	.55	.50	.50	18	.....	.85	1.40	.75	.50	2.08
4	.....	.50	1.15	1.80	.50	.50	19	.....	2.20	.70	.52	1.48	1.85
5	.....	.50	.65	.90	.65	.50	20	1.60	.70	.88	.50	.65	1.10
6	.....	.50	.60	.70	.65	.50	21	.75	.58	.70	.50	2.05	.68
7	.....	.50	1.20	1.50	.55	.50	22	1.40	.55	1.70	.50	2.35	.50
8	.....	.58	1.20	1.05	.58	.50	23	.70	.55	1.15	.50	1.75	.50
9	.....	.60	.70	.70	.50	.50	24	.65	1.70	1.20	.50	1.70	.50
10	.....	.55	.68	.65	.50	.50	25	.62	1.50	.90	.50	05	.50
11	.....	.58	1.80	.70	.50	.50	26	.60	.72	1.80	.52	.60	.50
12	.....	.95	1.12	.62	.50	.50	27	.60	1.00	1.88	.50	.50	.50
13	.....	1.35	.65	.52	.90	1.75	28	.60	.82	1.65	.50	1.55	.50
14	.....	.60	.65	.50	.80	1.50	29	.62	1.80	1.30	.50	1.45	.50
15	.....	1.05	1.05	.55	.65	3.50	30	.65	1.70	2.00	.50	.68	.50
							31	.6	1.10	.....	.50	.....	.65

NEW HAMAKUA DITCH AT WAIMA, NEAR WAIPIO, HAWAII.

Since the opening of the New Hamakua ditch in July, 1910, the Hawaiian Irrigation Co. has kept a record of the gage heights in the Waima flume which is below the last intake into the ditch and about 6 miles above the measuring weir at Kukuihaele. As soon as sufficient measurements are made for rating the section the daily discharge of the ditch at this point will be computed.

Discharge measurements of New Hamakua ditch at Waima, near Waipio, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Inches.*	*Sec.-ft.*
May 26	W. F. Martin	6.9	23.3	39½	63

NEW HAMAKUA DITCH AT WEIR, NEAR KUKUIHAELE, HAWAII.

The Hawaiian Irrigation Co. has a large weir on the New Hamakua ditch at Kukuihaele (Pl. X, *B*). The weir consists of six 5-foot panels with a good stilling basin and is undoubtedly one of the best and most reliable weirs in the Territory. An automatic clock register is used for recording the head. The records at this weir include the total flow of the ditch exclusive of water sent over the waste way a few hundred feet above. The records for this weir have been furnished to the Geological Survey by the Hawaiian Irrigation Co.

Discharge measurements of New Hamakua ditch at weir, near Kukuihaele, Hawaii, in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Inches.*	*Sec.-ft.*
May 25	W. F. Martin	6.8	15.0	8.1	55
27	do	8.6	18.9	8.1	53
27	do	8.7	19.6	8.1	55

NOTE.—Gage height is depth of water on weir.

Daily discharge, in second-feet, of New Hamakua ditch at weir, near Kukuihaele, Hawaii, for 1910–11.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.							1910.						
1	.....	53	58	68	54	61	16	.....	60	59	55	50	58
2	.....	55	57	70	53	61	17	.....	58	53	54	60	58
3	.....	58	56	68	53	61	18	14	56	52	53	67	57
4	.....	57	56	66	52	62	19	37	59	51	52	63	56
5	.....	58	55	58	52	62	20	41	68	50	55	58	56
6	.....	65	55	65	51	62	21	43	62	50	67	64	56
7	.....	65	54	63	51	62	22	49	68	51	58	60	56
8	.....	66	54	67	52	61	23	53	68	51	61	69	56
9	.....	66	54	69	51	61	24	50	68	50	64	69	61
10	.....	66	53	69	54	62	25	49	68	51	57	69	62
11	.....	65	53	69	61	62	26	50	68	51	55	60	61
12	.....	65	52	65	52	62	27	49	68	50	54	56	59
13	.....	66	52	61	51	61	28	51	68	53	65	54	56
14	.....	64	52	58	50	60	29	50	67	64	69	66	55
15	.....	65	55	56	49	59	30	49	63	68	60	68	54
							31	50	61	.....	56	.....	54

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1	54	65	50	53	53	53	54	58	62	53	57	53
2	64	63	50	53	53	54	54	58	62	53	58	53
3	62	64	51	53	53	53	54	60	56	53	58	53
4	54	64	50	53	55	53	54	60	56	53	59	53
5	50	63	50	53	54	53	54	59	56	53	59	53
6	56	63	50	53	53	53	53	58	56	53	58	55
7	53	62	50	53	53	54	54	59	56	54	58	55
8	53	51	50	54	53	54	53	60	56	53	58	55
9	53	47	50	53	54	54	54	61	56	53	58	54
10	53	16	50	53	53	54	53	61	56	64	57	53
11	53	.8	50	53	54	54	54	61	56	65	58	53
12	53	11	50	53	53	54	53	61	56	65	56	52
13	53	21	50	53	59	55	54	61	57	65	57	55
14	54	15	50	53	60	54	54	62	56	64	58	55
15	54	25	50	55	65	54	53	62	56	64	59	55
16	53	26	50	54	68	54	54	62	64	65	57	55
17	53	25	50	59	58	54	53	62	66	55	58	56
18	54	32	51	56	54	54	53	62	57	54	58	56
19	54	36	52	53	54	54	54	61	56	54	59	56
20	54	36	52	53	53	54	54	61	57	54	58	56
21	54	38	52	53	54	54	55	61	56	54	58	56
22	53	38	52	53	53	54	54	61	56	53	59	55
23	51	37	52	53	53	54	54	61	52	56	58	55
24	52	37	52	53	54	54	54	62	52	58	58	55
25	59	37	52	53	54	54	54	61	53	58	59	55
26	64	39	53	53	54	54	54	61	53	58	57	56
27	60	38	53	53	54	53	54	62	53	57	58	56
28	63	38	54	54	54	54	54	61	53	57	59	56
29	63	.....	54	53	53	54	54	61	53	57	58	56
30	63	.....	53	53	53	54	54	62	53	58	58	53
31	55	.....	53	.....	53	.....	54	62	.....	57	.....	56

NOTE.—Daily discharge in second-feet computed by the Geological Survey from records of daily discharge in gallons per 24 hours furnished by the Hawaiian Irrigation Co.

Monthly discharge of New Hamakua ditch at weir, near Kukuihaele, Hawaii, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
July 18–31	53	14	45.4	1,260
August	68	53	63.4	3,900
September	68	50	54.0	3,210
October	70	52	61.5	3,870
November	69	49	57.3	3,410
December	62	54	59.2	3,640
1911.				
January	64	50	55.6	3,420
February	65	.8	38.8	2,150
March	54	50	51.2	3,150
April	59	53	53.5	3,180
May	68	53	54.9	3,380
June	55	53	53.8	3,200
July	55	53	53.8	3,310
August	62	58	60.8	3,740
September	66	52	56.2	3,340
October	65	53	57.1	3,510
November	59	56	58.0	3,450
December	56	52	54.7	3,360
The year	68	.8	54.1	39,200

DISCHARGE MEASUREMENTS OF WAIPIO RIVER AND TRIBUTARIES IN 1901–2.

During the months of September, October, November, and December, 1901, and January, 1902, measurements were made of Waipio River and of the four principal tributaries at various elevations by Arthur S. Tuttle, civil engineer. Mr. Tuttle was employed in this work by the trustees of the estate of B. P. Bishop, who were interested in the development of an irrigation supply from Waipio Valley. The records have been furnished to the Geological Survey by the trustees of the estate of B. P. Bishop through the courtesy of Mr. F. S. Dodge, superintendent. Records were kept of daily precipitation during the period of measurements, and these are given as an aid to making estimates for the days on which discharge measurements were not obtained.

The records state that daily discharge was "determined by weir readings and the calibration of river gages."

Rainfall in inches at Waipio Valley, Hawaii, during the period Aug. 3, 1901, to Jan. 22, 1902.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	(t)	0.00	0.00	0.05	0.14	16	(r)	0.00	0.36	0.00	0.00	0.02
2	.....	0.01	.00	.04	.03	.05	17	(r)	.00	.04	.00	.00	.00
3	0.00	.38	.00	(t)	.12	(t)	18	(r)	.08	.08	.22	.00	.21
4	.00	.11	.00	.14	.04	(t)	19	(r)	.21	.00	(t)	.64	.00
5	(r)	(t)	.39	.08	.11	.03	20	(r)	.00	.20	.00	.00	.00
6	(r)	.00	.00	.34	.10	.17	21	.00	.04	.13	.04	.00	(t)
7	(r)	.00	.08	.56	.00	.03	22	.00	.00	.61	.12	.00	.03
8	(r)	.00	(t)	1.30	.51	.00	23	.06	.01	.41	.10	.76	.....
9	(r)	.00	.00	3.30	.00	1.55	24	.23	.00	.23	.00	.55	.....
10	(r)	.00	.00	3.00	(t)	.43	25	.03	.00	.28	.32	.00	.....
11	(r)	.44	.00	.10	.21	(t)	26	(t)	.00	(t)	.00	(t)	.....
12	(r)	.00	.01	.15	.00	.35	27	.22	.02	.47	.05	.05	.....
13	(r)	.08	(t)	.79	.00	.18	28	.14	.00	.04	.00	1.55	.....
14	.00	(t)	.00	.30	.00	.34	29	.49	.00	(t)	.00	2.28	.....
15	.00	.00	.00	.50	.00	.02	30	.76	.00	.00	.00	.21	.....
							31	.00	.....	.00	.....	.08	.....
							The month.	[a]1.93	1.38	3.33	11.45	7.29	[b]3.55

[a] Aug. 21 to 31.
[b] Jan. 1 to 22.
r Rain, but amount not measured.
t Trace of rain, but too small to measure.

NOTE.—The record for each day includes the precipitation for the 24 hours ending at 6 a. m.

Daily discharge, in second-feet, of Waipio River at elevation 360 feet, near Waipio, Hawaii, for Aug. 15, 1901, to Jan. 22, 1902.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	93	56	71	60	122	16	.....	80	59	.....	58	.....
2	.....	78	55	64	60	148	17	68	102	85	.....	55	.....
3	.....	263	55	63	67	191	18	73	69	62	.....	53	89
4	.....	134	53	66	.....	100	19	73	100	59	253	51	98
5	.....	82	51	77	83	100	20	217	84	53	100	53	.....
6	.....	83	61	122	100	80	21	128	73	60	86	52	96
7	.....	70	60	116	92	75	22	88	69	85	80	51	82
8	.....	72	60	.....	72	125	23	72	66	176	120	49	.....
9	.....	66	68	262	120	80	24	92	64	148	112	83	.....
10	.....	63	60	.....	81	254	25	130	61	119	81	114	.....
11	.....	63	54	.....	184	160	26	93	60	194	90	70	.....
12	.....	149	52	.....	102	82	27	86	60	116	75	57	.....
13	.....	98	51	230	60	186	28	86	60	.....	72	56	.....
14	.....	98	87	259	64	.....	29	81	58	122	68	420	.....
15	69	124	61	.....	57	158	30	172	56	88	63	242	.....
							31	164	.....	77	.....	258	.....

Daily discharge, in second-feet, of Kawainui Stream at elevation 2,120 feet, near Waipio, Hawaii, for Sept. 24, 1901, to Jan. 16, 1902.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	5.4	9.0	.....	.....	16	.....	8.1	.....	6.9	10
2	.....	6.5	8.1	.....	.....	17	.....	13	.....	6.6	.....
3	.....	6.4	7.4	.....	.....	18	.....	9.6	.....	7.1	.....
4	.....	6.5	7.4	.....	.....	19	.....	8.2	.....	6.2	.....
5	.....	6.4	8.1	.....	.....	20	.....	6.9	.....	6.9	.....
6	.....	11	.....	.....	.....	21	.....	.....	.....	5.8	.....
7	.....	11	.....	.....	.....	22	.....	16	.....	6.2	.....
8	.....	12	.....	.....	.....	23	.....	.....	.....	.....	.....
9	.....	13	.....	.....	.....	24	6.6	.....	.....	.....	.....
10	.....	9.0	.....	.....	.....	25	6.4	20	.....	.....	.....
11	.....	8.0	.....	60	.....	26	6.4	.....	.....	.....	.....
12	.....	7.0	.....	14	.....	27	6.8	30	.....	.....	.....
13	.....	7.0	.....	9.8	.....	28	6.8	.....	.....	.....	.....
14	.....	15	.....	7.6	.....	29	6.5	22	.....	.....	.....
15	.....	7.6	.....	7.6	.....	30	5.6	12	.....	.....	.....
						31	.....	9.4	.....	.....	.....

Daily discharge, in second-feet, of Kawainui Stream at elevation 1,435 feet, near Waipio, Hawaii, for Oct. 5, 1901, to Jan. 16, 1902.

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1	.....	12	12	.....	16	10	.....	9.9	13
2	.....	11	12	.....	17	17	.....	9.6	.....
3	.....	11	12	.....	18	12	.....	10	.....
4	.....	10	13	17	19	10	.....	9.2	.....
5	8.6	11	19	15	20	9.6	19	9.9	.....
6	12	63	19	.....	21	10	14	8.8	.....
7	12	27	17	.....	22	19	20	9.2	.....
8	13	75	15	.....	23	69	18	9.2	.....
9	16	.....	37	14	24	33	.....	.....	.....
10	11	.....	16	.....	25	26	14	.....	.....
11	13	.....	65	35	26	60	15	13	.....
12	9.2	.....	16	.....	27	34	14	14	.....
13	9.3	.....	13	.....	28	41	13	10	.....
14	18	.....	11	.....	29	28	12	.....	.....
15	12	.....	11	.....	30	17	12	.....	.....
					31	13	.....	21	.....

Daily discharge, in second-feet, of Kawainui Stream at elevation 775 feet, near Waipio, Hawaii, for Sept. 14, 1901, to Jan. 20, 1902.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	16	20	20	44	16	24	17	.....	18	33
2	.....	16	19	19	90	17	24	24	.....	18	36
3	.....	15	18	27	67	18	20	19	.....	18	.....
4	.....	16	17	28	32	19	35	17	47	18	38
5	.....	15	19	34	38	20	27	16	41	18	34
6	.....	18	67	33	.....	21	21	17	27	18	.....
7	.....	19	36	29	20	22	21	26	23	18	.....
8	.....	20	90	22	53	23	19	77	32	17	.....
9	.....	24	.....	40	23	24	18	44	43	23	.....
10	.....	19	.....	24	105	25	18	37	26	26	.....
11	.....	17	.....	76	59	26	17	74	28	22	.....
12	.....	16	.....	29	25	27	16	38	24	21	.....
13	.....	16	.....	22	81	28	16	50	22	18	.....
14	32	26	.....	20	59	29	16	38	20	.....	.....
15	41	18	.....	19	72	30	16	24	20	.....	.....
						31	.....	21	.....	44	.....

Daily discharge, in second-feet, of Branch No. 3 of Kawainui Stream at elevation 1,700 feet, near Waipio, Hawaii, for Sept. 10, 1901, to Jan. 16, 1902.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	0.4	0.8	0.9	.....	16	0.9	0.4	.....	0.6	1.3
2	.....	.4	.6	.8	.....	17	.7	.7	.....	.6	.....
3	.....	.3	.6	.7	.....	18	.7	.5	.....	.6	.....
4	.....	.5	.6	1.0	.....	19	1.2	.5	.....	.6	.....
5	.....	.4	.7	1.3	.....	20	1.0	.5	1.6	.6	.....
6	.....	.5	1.7	1.2	.....	21	.9	.5	1.3	.5	.....
7	.....	.4	1.0	1.0	.....	22	.9	.8	1.0	.6	.....
8	.....	.5	2.9	.8	.....	23	.7	3.2	1.4	.....	.....
9	.....	.5	.....	1.3	0.3	24	.6	1.6	.....	.....	.....
10	0.7	.4	.....	.9	.....	25	.5	1.3	1.2	.....	.....
11	.9	.4	.....	1.6	1.1	26	.5	3.7	.7	.....	.....
12	2.0	.4	.....	1.0	.....	27	.4	1.4	1.2	.....	.....
13	1.7	.4	.....	.8	.....	28	.5	.....	1.0	.....	.....
14	1.5	.4	.....	.8	.....	29	.4	1.6	.9	.....	.....
15	1.6	.4	.....	.7	.....	30	.4	1.0	.8	.....	.....
						31	.....	.9	.....	.....	.....

Daily discharge, in second-feet, of Branch No. 2 of Kawainui Stream at elevation 1,40[illegible] feet, near Waipio, Hawaii, for Sept. 5, 1901, to Jan. 16, 1902.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	1.1	1.1	1.1	.....	16	1.2	0.9	.....	1.2	1.[illegible]
2	.....	1.0	1.0	1.1	.....	17	1.2	1.2	.....	1.0	.....
3	.....	1.0	1.0	1.0	.....	18	1.1	1.0	.....	1.2	.....
4	.....	1.0	1.1	1.3	1.4	19	1.2	1.0	.....	1.1	.....
5	1.2	1.0	1.1	1.4	1.0	20	1.5	1.0	1.5	1.2	.....
6	1.1	1.1	2.0	1.4	.....	21	1.2	1.6	1.3	1.1	.....
7	1.0	1.1	1.4	1.2	.....	22	1.1	1.4	1.2	1.1	.....
8	.....	1.1	2.3	1.0	.....	23	1.1	3.4	1.5	1.1	.....
9	1.0	1.1	.....	1.3	1.2	24	1.0	1.7	.....	.....	.....
10	1.2	1.0	.....	1.2	.....	25	1.0	1.2	1.2	.....	.....
11	1.1	1.0	.....	1.2	2.2	26	1.0	2.0	.6	1.1	.....
12	1.5	1.0	.....	1.2	.....	27	1.0	1.3	1.2	1.1	.....
13	1.3	1.0	.....	1.2	.....	28	1.0	1.7	1.1	.9	.....
14	1.3	1.0	.....	1.1	.....	29	1.0	1.5	1.2	.....	.....
15	1.4	1.2	.....	1.1	.....	30	1.0	1.3	1.1	.....	.....
						31	.....	1.1	.....	1.7	.....

Daily discharge, in second-feet, of Branch No. 1 of Kawainui Stream at elevation 1,380 feet, near Waipio, Hawaii, for Sept. 5, 1901, to Jan. 16, 1902.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	0.7	0.8	0.8	.....	16	1.0	0.6	.....	0.7	1.2
2	.....	.6	.8	.8	.....	17	.9	.8	.....	.7	.....
3	.....	.6	.8	.7	.....	18	.8	.6	.....	.6	.....
4	.....	.6	.7	.8	1.1	19	1.2	.6	.....	.7	.....
5	1.3	.6	.8	1.1	1.2	20	1.7	.6	1.6	.7	.....
6	1.0	.8	1.7	1.1	.....	21	1.0	.7	1.2	.6	.....
7	.9	.6	1.1	.9	.....	22	1.1	.9	1.1	.6	.....
8	.....	.7	2.2	.7	.....	23	.8	3.5	1.5	.6	.....
9	.8	.7	.....	1.0	1.0	24	.6	1.8	.....	.....	.....
10	.8	.6	.....	.9	.....	25	.8	1.4	1.1	.....	.....
11	.8	.6	.....	1.5	3.1	26	.8	4.4	1.1	.7	.....
12	1.6	.6	.....	.9	.....	27	.7	1.5	.9	.7	.....
13	1.4	.6	.....	.8	.....	28	.7	2.4	.9	.6	.....
14	1.1	.6	.....	.7	.....	29	.7	1.6	.8	.....	.....
15	1.3	.6	.....	.7	.....	30	.7	1.2	.8	.....	.....
						31	.....	.9	.....	1.5	.....

Daily discharge, in second-feet, of Alakahi Stream at elevation 1,200 feet, near Waipio, Hawaii, for Oct. 3, 1901, to Jan. 17, 1902.

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1	.....	10	10	.....	16	10	.....	9.4	.....
2	.....	10	9.9	.....	17	11	.....	9.8	14
3	9.6	10	9.7	29	18	10	.....	12	.....
4	9.3	10	.....	.....	19	10	.....	11	.....
5	9.0	10	14	15	20	9.9	15	9.0	.....
6	.....	.....	14	.....	21	10	11	9.0	.....
7	9.5	13	12	.....	22	12	11	8.9	.....
8	9.8	.....	11	.....	23	.....	12	9.0	.....
9	11	.....	14	.....	24	17	18	.....	.....
10	10	.....	11	.....	25	15	11	.....	.....
11	.....	.....	.....	.....	26	36	12	10	.....
12	9.6	.....	13	.....	27	15	10	8.6	.....
13	9.9	.....	11	.....	28	31	11	8.5	.....
14	9.3	.....	10	.....	29	15	11	.....	.....
15	9.9	.....	9.7	22	30	12	10	.....	.....
					31	11	.....	.....	.....

Daily discharge, in second-feet, of Alakahi Stream at elevation 730 feet, near Waipio, Hawaii, for Aug. 31, 1901, to Jan. 19, 1902.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1			14	16	16	20	16		17	14		15	17
2		18	14	15	15	45	17		16	16		14	15
3		15	14	14	15	31	18		15	14		15	
4		34	14	14		17	19		21	14	25	14	13
5		21	14	16	20	17	20		21	14	23	14	
6		18	15	24	20		21		17	14	19	14	
7		17	15	20	17	16	22		16	18	18	14	
8		15	15	28	15	16	23		15	35	19	14	
9		15	15		21	17	24		15	25	18	17	
10		15	17		17	65	25		15	22	19	18	
11		15	15		57	30	26		14	47	20	15	
12		33	14		20	15	27		14	20	19	14	
13			15		16	49	28		14	34	17	12	
14		20	15		16	36	29		14	22	17		
15		22	15		15	34	30		14	18	16	49	
							31	24		16		20	

Daily discharge, in second-feet, of Koiawe Stream at elevation 1,120 feet, near Waipio, Hawaii, for Oct. 4, 1901, to Jan. 4, 1902.

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1		6.3	6.2		16	5.8		6.4	
2		5.8	6.0	15	17	6.0		6.0	
3		5.1	6.2		18	5.8		6.2	
4	6.3	5.1		8.6	19	5.8		6.0	
5		6.0	6.2		20	5.6	9.7	6.2	
6		6.3	7.3		21	5.7	8.6	6.2	
7		9.8	7.0		22	7.2	6.8	6.1	
8			6.4		23	15	8.0	6.1	
9	6.3		10		24	13		8.0	
10	6.1		6.5		25	15	7.9		
11	6.0		26		26	15	8.8	7.8	
12	5.8		8.4		27		8.0	6.3	
13	6.2		6.8		28		7.6	6.0	
14	5.6		6.6		29	9.7	6.4		
15	5.6		6.3		30	7.2	6.2		
					31	6.4		13	

Daily discharge, in second-feet, of Koiawe Stream at elevation 610 feet, near Waipio, Hawaii, for Aug. 26, 1901, to Jan. 22, 1902.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1		13	10	10	10	13	16		11	10		9.9	15
2		13	10	9.9	9.7	20	17		11	10		9.6	12
3		13	10	9.5	10	21	18		11	10		9.6	
4		19	11	8.5		13	19		12	10	18	9.9	11
5		16	10	8.7	11	14	20		11	9.9	14	9.6	13
6		12	10	9.2	12		21		12	9.9	13	9.6	
7		12	10	11	12	13	22		11	12	12	9.3	12
8		12	10		10	14	23		11	21	12	9.4	
9		12	10		14	12	24		11	19	14	11	
10		12	11		9.4	40	25		11	17	12	11	
11		11	10		39	21	26	12	11	20	14	10	
12		22	10		13	12	27	12	10	13	12	9.7	
13			10		11	20	28	15	11		12	9.0	
14		12	10		10	20	29	31	11	14	11		
15		12	10		9.1	18	30	15	10	11	11	29	
							31	20		10		16	

Daily discharge, in second-feet, of Waima Stream at elevation 790 feet, near Waipio, Hawaii, for Aug. 3, 1901, to Jan. 5, 1902.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	9.7	8.8	.....	8.8	.....	16	7.0	8.8	8.0	.....	9.5	.....
2	.....	9.6	8.8	7.0	8.4	9.4	17	8.7	8.2	8.0	.....	9.4	.....
3	9.0	13	8.7	7.0	9.3	9.2	18	9.4	.....	8.6	.....	9.2	.....
4	9.2	9.7	8.8	7.5	.....	8.9	19	9.2	8.0	7.6	14	8.2	.....
5	9.7	9.5	8.8	.....	8.4	9.0	20	.....	8.3	7.4	13	9.3	.....
6	9.9	9.5	9.2	7.5	8.4	.....	21	8.9	8.6	7.2	13	9.2	.....
7	8.9	9.5	8.9	8.8	8.5	.....	22	8.8	7.9	7.6	12	9.4	.....
8	9.0	9.5	8.5	.....	9.2	.....	23	8.4	8.0	7.2	11	9.6	.....
9	8.6	9.8	8.2	.....	9.5	.....	24	9.3	8.4	8.0	12	9.7	.....
10	8.6	8.8	8.6	.....	7.6	.....	25	10	8.8	8.8	11	9.6	.....
11	8.4	8.8	8.5	.....	8.9	.....	26	9.2	8.4	7.5	12	9.4	.....
12	7.7	9.8	8.4	.....	8.2	.....	27	9.5	.....	.....	12	9.6	.....
13	7.2	.....	8.7	.....	8.2	.....	28	9.5	8.8	.....	12	9.2	.....
14	7.5	8.8	8.5	.....	9.5	.....	29	9.4	8.8	8.0	11	.....	.....
15	7.2	.....	7.7	.....	8.2	.....	30	9.6	8.8	7.0	9.3	14	.....
							31	10	.....	7.0	.....	.....	.....

Daily discharge, in second-feet, of Waima Stream at elevation 385 feet, near Waipio, Hawaii, Aug. 17, 1901, to Jan. 6, 1902.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Day.	A ug	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	19	18	17	19	20	16	.....	19	17	.....	20	.....
2	.....	19	18	18	19	19	17	18	19	19	.....	19	.....
3	.....	22	18	18	20	19	18	18	19	19	.....	19	.....
4	.....	22	17	18	.....	19	19	22	20	18	23	18	.....
5	.....	18	17	19	19	19	20	.....	20	18	22	19	.....
6	.....	18	17	18	19	19	21	.....	19	17	22	19	.....
7	.....	18	19	18	19	.....	22	17	19	18	21	19	.....
8	.....	19	19	.....	19	.....	23	17	19	17	20	20	.....
9	.....	19	18	.....	20	.....	24	20	19	17	21	20	.....
10	.....	19	18	.....	18	.....	25	20	17	19	20	20	.....
11	.....	19	18	.....	19	.....	26	19	19	19	21	19	.....
12	.....	19	17	.....	18	.....	27	19	18	18	21	20	.....
13	.....	19	18	.....	18	.....	28	20	18	.....	21	19	.....
14	.....	19	18	.....	20	.....	29	19	18	18	20	.....	.....
15	.....	18	18	.....	18	.....	30	18	18	19	20	24	.....
							31	19	.....	17	.....	20	.....

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements have been made on streams and ditches of the Hamakua group:

Miscellaneous measurements in Hamakua group in 1911.

Date.	Stream.	Locality.	Discharge.
			Sec.-ft.
Mar. 3	Waipunalei	Near public road	0.8
3	Kawalii	do	*a* 1.0
May 25	Feeder ditch *b*	Kukuihaele	8.9

a Estimated. *b* Measurement made 50 feet below 5-foot weir.

KOHALA GROUP OF STREAMS.

GENERAL FEATURES.

The Kohala group includes all streams on the northern slope of the Kohala Mountains from Awini Stream westward. The principal streams are Awini, Honokane, and Pololu, the largest of which is Honokane. Honokane Stream has two main branches which rise high up on the mountains. The water from these streams is intercepted by a series of ditches which carry the water westward for irrigation.

HONOKANE STREAM BASIN.

DISCHARGE MEASUREMENTS OF THE EAST AND WEST BRANCHES OF THE HONOKANE STREAM IN 1901.

During the months of October, November, and December, 1901, measurements were made of the two branches of the Honokane Stream at different elevations by Arthur S. Tuttle, civil engineer. Mr. Tuttle was employed in this work by the trustees of the estate of B. P. Bishop, who were interested in the development of an irrigation supply from this source. The records have been furnished the Geological Survey by the trustees of the estate of B. P. Bishop through the courtesy of Mr. F. S. Dodge, superintendent. Records were kept of daily precipitation during the period of measurements, and these are given as an aid to making estimates for the days on which discharge measurements were not obtained.

The records state that daily discharge was "determined by weir readings and the calibration of river gages."

Rainfall, in inches, at Honokane Valley, Hawaii, during the period Oct. 18 to Dec. 31, 1901.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	0.02	(a)	16	.....	(a)	(a)
2	.....	.03	(a)	17	.....	0.15	0.00
3	.....	.40	0.30	18	0.15	.30	.00
4	.....	.05	.10	19	(a)	.35	.20
5	.....	1.00	.20	20	.10	(a)	.00
6	.....	1.20	.20	21	.30	.05	.00
7	.....	1.15	.00	22	.30	.08	.00
8	.....	4.10	1.40	23	.20	.23	.80
9	.....	1.40	.00	24	.10	(a)	.15
10	.....	.10	.85	25	.15	.75	(a)
11	.....	.80	.20	26	.25	.00	(a)
12	.....	.50	(a)	27	.15	.10	.15
13	.....	.40	.00	28	.15	.00	2.30
14	.....	1.70	.00	29	(a)	.00	3.15
15	.....	.10	(a)	30	.00	(a)	(a)
				31	.02	.....	.00
				The month	b 1.87	14.96	10.00

a Trace of rain, but too small to measure. b Oct. 18 to 31.

NOTE.—The record for each day includes the precipitation for the 24 hours ending at 6 a. m.

Daily discharge, in second-feet, of East Branch of Honokane Stream at elevation 1,30(feet, near Honokane, Hawaii, for Nov. 11 to Dec. 31, 1901.

Day.	Nov	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		7.6	11	21	62	21	12	7.
2		7.6	12	56	21	22	10	7.
3		7.3	13	28	12	23	13	7.
4		7.7	14	60	9.6	24	20	13
5		10	15	26	8.8	25	11	14
6		13	16	19	8.8	26	13	8.
7		11	17	18	7.8	27	10	8.
8		8.4	18	24	8.3	28	9.0	7.
9		11	19	26	7.4	29	8.4	90
10		12	20	24	7.4	30	7.8	72
						31		22

Monthly discharge of East Branch of Honokane Stream at elevation 1,300 feet, near Hono kane, Hawaii, for Nov. 11 to Dec. 31, 1901.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
Nov. 11–30	60	7.8	20.8	82
December	90	7.1	16.3	1,00

Daily discharge, in second-feet, of East Branch of Honokane Stream at elevation 770 feet near Honokane, Hawaii, for Oct. 21 to Dec. 31, 1901.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		23	14	11		28	83	21	24	20	1
2		23	14	12		57	28	22	25	17	1
3		22	14	13		38	19	23	40	18	1
4		22	15	14		68	17	24	33	24	2
5		22	17	15		42	16	25	31	18	2
6		47	21	16		26	16	26	64	20	1
7		38	18	17		24	15	27	48	17	1
8		68	16	18		30	15	28	68	16	1
9		80	26	19		28	14	20	38	15	10
10		46	21	20		26	14	30	28	15	7
								31	26		6

Monthly discharge of East Branch of Honokane Stream at elevation 770 feet, near Hono kane, Hawaii, for Oct. 21 to Dec. 31, 1901.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
Oct. 21–31	68	24	38.6	84
November	80	15	31.3	1,86
December	102	13	25.4	1,56

Daily discharge, in second-feet, of West Branch of Honokane Stream at elevation 1,370 feet, near Honokane, Hawaii, for Nov. 4 to Dec. 31, 1901.

Day	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.6	11	4.2	30	21	0.9	0.6
2		.6	12	5.7	5.8	22	.8	.6
3		.6	13	3.4	2.4	23	1.1	.6
4	0.25	.7	14	8.4	1.4	24	1.1	.8
5	.27	.7	15	4.7	1.1	25	1.1	1.4
6	1.2	.7	16	2.6	.9	26	1.3	.9
7	1.7	.7	17	2.0	.7	27	1.1	.8
8	4.0	.6	18	2.0	.8	28	1.0	.6
9	24	3.7	19	1.4	.6	29	.8	45
10	7.6	2.2	20	1.2	.7	30	.7	25
						31		6.1

Monthly discharge of West Branch of Honokane Stream at elevation 1,370 feet, near Honokane, Hawaii, for Nov. 4 to Dec. 31, 1901.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 4–30	24	0.25	3.13	168
December	45	.6	4.45	274

Daily discharge, in second-feet, of West Branch of Honokane Stream at elevation 775 feet, near Honokane, Hawaii, for Oct. 21 to Dec. 31, 1901.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		0.21	0.24	11		2.7	35	21	0.10	0.5	0.15
2		.10	.24	12		3.6	4.5	22	.10	.38	.12
3		.04	.14	13		2.4	1.8	23	.10	.40	.11
4		.08	.6	14		14	.9	24	.05	.47	.6
5		.17	.31	15		5.5	.6	25	.10	.47	.9
6		.47	.21	16		2.2	.48	26	1.0	.6	.5
7		1.5	.19	17		1.3	.27	27	2.3	.5	.41
8		12	.16	18		1.5	.39	28	2.8	.48	.24
9		25	4.3	19		1.0	.29	29	1.9	.8	51
10		1.6	1.6	20		.6	.20	30	1.0	.22	28
								31		.49	5.5

Monthly discharge of West Branch of Honokane Stream at elevation 775 feet, near Honokane, Hawaii, for Oct. 21 to Dec. 31, 1901.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 21–31	2.8	0.05	0.90	20
November	25	.04	2.69	160
December	51	.11	4.51	277

KOHALA DITCH NEAR KOHALA, HAWAII.

The Kohala ditch heads in Awini Stream at elevation of 1,040 feet and extends westward, taking in water from the several streams. An upper ditch, recently constructed, heads in the eastern branch of Honokane Stream at an elevation of 4,200 feet and is used to supplement the lower ditch. These ditches have been constructed by the Kohala Ditch Co., which supplies water to the plantations in

Kohala. The total flow of the ditch is measured by a weir, and the records for 1910 and 1911 have been furnished to the Geological Survey by the Kohala Ditch Co. through the courtesy of Mr. P. W. P. Bluett, superintendent.

Daily discharge, in second-feet, of Kohala ditch near Kohala, Hawaii, for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	24	44	38	44	44	44	49	49	33	49	24	49
2	23	44	38	44	44	44	49	49	28	49	23	49
3	23	44	48	44	44	44	49	49	28	36	23	49
4	23	44	44	44	44	44	49	49	24	35	20	49
5	30	44	44	44	44	44	49	49	24	28	19	49
6	48	44	44	44	44	44	49	49	23	33	22	49
7	34	44	44	44	44	44	49	49	23	33	18	49
8	31	44	44	44	44	44	49	49	23	54	18	49
9	27	44	36	44	44	44	49	49	23	54	18	49
10	36	38	34	44	44	44	49	49	23	54	17	49
11	38	36	34	44	44	44	49	49	23	54	20	40
12	44	38	31	44	44	44	49	49	22	36	20	40
13	54	54	30	38	44	44	49	49	20	34	18	40
14	54	44	29	36	44	44	49	49	20	25	17	36
15	48	39	27	36	44	44	49	49	23	24	17	36
16	48	38	25	44	44	44	49	49	28	24	15	35
17	51	38	25	54	44	44	49	38	25	24	27	34
18	63	36	24	54	44	44	49	29	24	22	54	33
19	54	35	24	45	44	44	49	30	23	19	49	31
20	54	35	54	44	44	44	49	66	19	19	47	28
21	54	36	54	44	34	44	49	66	18	28	47	27
22	48	44	54	38	34	44	49	54	18	34	47	27
23	48	44	54	34	34	44	49	49	17	35	66	27
24	48	44	54	38	34	44	49	49	17	29	63	27
25	44	38	54	39	33	44	49	49	17	27	49	31
26	44	36	54	48	31	44	49	49	17	24	36	30
27	44	36	54	35	31	44	49	49	17	20	35	30
28	44	36	54	35	30	44	49	49	17	24	33	30
29	44	.....	54	36	28	44	49	38	16	51	66	30
30	44	.....	45	38	29	44	49	35	25	34	60	28
31	44	.....	44	.....	30	.....	49	35	.....	28	.....	28
1911.												
1	49	49	49	49	49	45	49	25	49	49	25	38
2	49	49	38	49	49	57	49	25	49	49	24	36
3	49	49	38	49	49	57	49	24	49	49	24	34
4	49	49	38	49	49	49	49	23	49	49	28	31
5	49	49	38	49	49	49	49	22	49	49	34	31
6	49	49	36	49	49	49	49	22	49	49	36	31
7	49	49	36	49	49	49	49	22	49	49	38	34
8	49	49	35	49	49	49	49	22	49	49	40	34
9	49	49	33	42	49	49	49	27	49	49	38	33
10	49	49	38	38	49	49	49	25	49	49	36	31
11	49	49	38	38	49	49	49	24	49	49	38	31
12	49	49	36	38	49	49	49	27	49	49	36	24
13	49	49	34	38	49	49	49	35	49	49	35	38
14	49	49	30	35	49	49	49	35	49	49	38	49
15	49	49	29	31	49	49	49	35	49	49	40	49
16	49	49	29	34	49	49	49	35	49	49	38	49
17	49	49	28	60	49	49	49	36	49	40	34	49
18	49	49	49	60	49	49	49	36	49	38	34	49
19	49	49	49	60	49	49	49	36	49	31	34	49
20	39	49	49	60	49	49	49	39	49	31	34	49
21	36	49	49	60	49	49	49	38	49	31	34	49
22	35	49	49	60	49	49	49	38	49	31	34	49
23	49	49	49	60	49	49	39	38	49	28	34	49
24	49	49	49	58	44	49	39	39	49	28	34	39
25	49	49	49	49	36	49	38	39	49	28	34	35
26	49	49	39	49	35	49	35	39	49	25	40	34
27	49	49	35	49	34	49	34	39	49	25	39	33
28	49	49	30	49	33	49	33	39	49	24	39	34
29	49	.....	28	49	33	49	30	40	49	24	40	35
30	49	.....	27	49	33	49	30	40	49	25	40	35
31	49	.....	60	.....	33	.....	30	40	.....	25	.....	38

Monthly discharge of Kohala ditch near Kohala, Hawaii, for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1910.				
January	63	23	42.4	2,610
February	54	35	40.8	2,270
March	54	24	41.7	2,560
April	54	34	42.1	2,510
May	44	28	39.6	2,430
June	44	44	44.0	2,620
July	49	49	49.0	3,010
August	66	29	47.4	2,910
September	33	16	21.9	1,300
October	54	19	33.5	2,060
November	66	15	32.9	1,960
December	49	27	37.4	2,300
The year	66	15	39.4	28,540
1911.				
January	49	35	47.8	2,940
February	49	49	49.0	2,720
March	60	27	39.2	2,410
April	60	31	48.6	2,890
May	49	33	45.4	2,790
June	57	45	49.4	2,940
July	49	30	44.7	2,750
August	40	22	32.4	1,990
September	49	49	49.0	2,920
October	49	24	39.3	2,420
November	40	24	35.1	2,090
December	49	24	38.7	2,380
The year	60	22	43.1	31,240

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements on the streams of the Kohala group were made during 1911:

Miscellaneous measurements in Honokane Stream drainage basin in 1911.

Date.	Stream.	Elevation.	Reference point.[a]	Discharge.
		Feet.	*Feet.*	*Sec.-ft.*
Dec. 14	East Branch of Honokane	4,200	0.33	30.1
14	Tributary No. 1	4,200	1.58	.6
14	Tributary No. 2	4,175	.35	5.2
14	Tributary No. 3	4,200	2.01	6.0
14	Tributary No. 4	4,182	.33	2.3
14	Tributary No. 5	4,202	.21	.8
14	Tributary No. 6	4,204	.86	1.3
14	Tributary No. 7	4,200	.34	.03
14	Tributary No. 8	4,200	2.81	.3
14	Tributary No. 9	4,037	.56	6.6
14	Tributary No. 10	4,025	3.27	.4
14	Tributary No. 11	4,020	.....	4.0
16	Tributary No. 12	4,018	1.21	1.0
16	Tributary No. 13	4,020	2.46	.7
16	Tributary No. 14	4,034	.50	.9
16	Tributary No. 15	4,013	.10	.9
16	Tributary No. 16	4,009	.21	1.2
16	Tributary No. 17	3,984	.19	1.0
16	Tributary No. 18	3,937	.15	.8
16	Tributary No. 19	3,876	2.71	.4
16	West Branch of Honokane	3,858	.23	5.7

[a] Distances measured to water surface from a fixed point above.

NOTE.—The streams are taken in order from east to west along the line of the upper Kohala ditch trail.

SPRINGS AND UNDERGROUND WATERS.

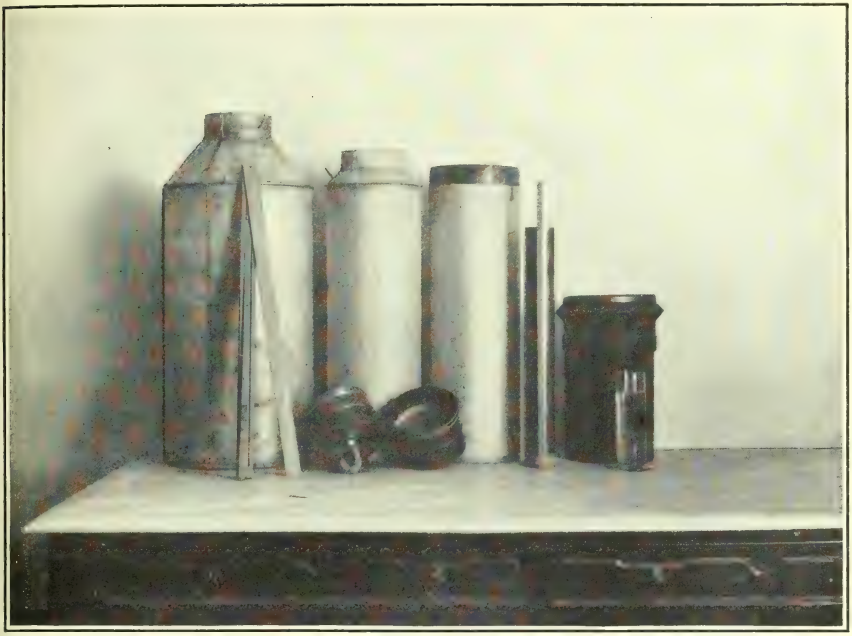
In many sections of the island of Hawaii the rain either runs off as rapidly as it falls or sinks immediately into the porous lava formation. In a few places underground water has been developed by tunneling, the Olaa Sugar Co. getting a large part of its water supply in this way. At many places at or near sea level there are springs which are fairly constant in their flow. One of these springs at Punaluu on the south coast is at sea level and is estimated to flow 30 to 40 second-feet. This particular spring may be the outlet of a submerged river, the original channel of which has been filled by lava flows. There is undoubtedly a large amount of underground water at some places on the island of Hawaii, particularly in the Puna district, but the difficulties in the way of developing it have so far prevented its utilization.

RAINFALL RECORDS.

GENERAL FEATURES.

Owing to the comparatively small drainage areas of streams in the Territory of Hawaii and the fact that practically all the precipitation is in the form of rain, the greater part of which if allowed to follow its natural course would reach the sea within a few hours, it must follow that there is a close relation between the rainfall and stream flow. This relation is accentuated by the heavy gradients of the streams and the steep slopes of the sides of their basins. As the water supply of every island is limited to what is precipitated between its shores, by measuring the rainfall some idea may be had of the total amount of run-off.

Rainfall records covering several years have been kept at a number of places on the islands, mostly at low elevations near the sea. These records are useful in showing the variation in rainfall from month to month and on the different sides of the islands, but do not tell the amount precipitated on the areas which supply the principal streams. To procure data covering this last point, which is of primary importance in connection with stream flow, it has been necessary to place rain gages in the mountains at places remote from all habitations and as a rule accessible only by difficult or even dangerous journeys on foot. Under these circumstances it is of course impossible to obtain daily readings, so a special type of gage was designed which could be read at intervals of one or two months as the amount of rainfall required and the accessibility of the station permitted. (See Pl. XI, *A*.) This type of gage consists of a galvanized-iron container, 8.40 inches diameter and 24 inches high, with a copper receiver 5.94 inches diameter joined to the container by a tapering neck. To prevent loss by evaporation the bottom of the receiver is contracted to an opening of $\frac{3}{8}$-inch diameter, to which is attached on the bottom a short tube



A. TYPES OF RAIN GAGES.

B. RAINFALL AND EVAPORATION STATION AT WAIAKOALI CAMP, KAUAI.

with an upturned end forming a trap. With this relation between the diameters of receiver and container a factor of 2 is introduced, so that the container holds 48 inches of rainfall when the water in it is 24 inches deep; when the gage is full to overflowing it contains 51.6 inches of rainfall. Other gages of the same type but larger are made by increasing the diameter of the container to 13.28 inches and 18.78 inches, which, by using the 5.94-inch receiver, give measuring factors of 5 and 10, respectively. The diameter of the receiver is made 5.94 inches in all the gages, so that 1 inch of rainfall taken by it will weigh 1 pound. This relation is made use of as a check on the measured depth of water in the gage, the observers being supplied with spring balances and required to weigh the gage before and after emptying.

Careful comparisons have been made of this special gage with the standard daily gage, United States Weather Bureau type, and it has been found impossible to discover any loss by evaporation from the former when read at intervals of one or two months.[1]

In studying the data given on the following pages it will be seen that the rainfall is much heavier back among the mountains than it is along the coast, and that in general the north and east slopes receive more rain than the south and west slopes. This is due to the fact that the moisture-laden "trade winds" coming from the northeast cause the greater amount of precipitation on the windward or koolau sides of the islands. The leeward or kona sides, being protected from the prevailing northeast winds, receive less rain, except when occasional kona storms come in from the south.

Although rain gages have been placed at a number of points at high elevations in the principal basins and on divides, it is not considered that the distribution of gages is as yet sufficiently complete to warrant the construction of isohyetose lines. In presenting the data, the amount of rainfall is given in inches per month so far as possible, and it is also expressed in inches per day for the year or period covered.

RAINFALL RECORDS ON ISLAND OF KAUAI.

During 1910 and 1911 rainfall records were obtained at 58 different stations on Kauai. Of these stations, 22 were above 1,000 feet in elevation, 17 were above 2,000 feet, and 13 were above 3,000 feet. The records at all the stations 2,000 feet and over in elevation, with one exception, were obtained by means of the United States Geological Survey special type of rain gage. In the following tables credit is given for use of the data collected by the United States Weather Bureau and also for those furnished by cooperating parties. A view of station No. 6 is shown in Plate XI, *B*. The location of the stations is shown on Plate XIII (at end of volume).

[1] See records at station No. 9, Oahu and station No. 14, Hawaii.

Rainfall stations on Island of Kauai.

	Elevation (feet).		Elevation (feet).
1. Kilohana	4,023	30. Lawai (west)	225
2. Lehuamakanoi	3,932	31. Lawai Beach	5
3. Paukahana	3,723	32. Koloa [1]	241
4. Mohihi-Koaie divide	3,950	33. Kukuiula	100
5. Mohihi, upper crossing	3,500	34. Puuhi	75
6. Waiakoali camp [1]	3,450	35. Mahaulepu	90
7. Kokee	3,550	36. Kamoola ditch	835
8. Puu Lua [1]	3,500	37. Wilcox ditch	725
9. Waialae	3,600	38. Aakukui	350
10. Keanakua	4,450	39. Kukaua	1,000
11. Kahana-Makuone divide	3,750	40. Lihue (Kilohana)	400
12. Waialeale	5,080	41. Molokoa	250
13. Olokele mauka	2,100	42. Grove farm	200
14. Olokele ditch	1,310	43. Lihue	200
15. Mana pump	30	44. Hanamaulu	200
16. Waiawa [1]	30	45. Waiahi	600
17. Kekaha	40	46. Hanahanapuni	911
18. Camp No. 7, near Waimea	150	47. Summit camp	1,900
19. Hiloa-Hanapepe divide	2,080	48. Kapehuala	3,130
20. Hanapepe Valley	510	49. Pohakupili	2,589
21. Makaweli	140	50. Pueo	2,747
22. Camp No. 2, near Hanapepe	250	51. Kapahi	300
23. Eleele	150	52. Kealia [1]	15
24. Wahiawa mauka	2,000	53. Halaula	250
25. McBryde residence	900	54. Kilauea	342
26. Wahiawa	225	55. Kapaka	1,123
27. Homestead	631	56. Sanborn's residence	105
28. Lawai (east)	600	57. Intake, Wainiha canal	700
29. Lawai (government road)	450	58. Power house, Kauai Electric Co	125

Rainfall at Kilohana (station No. 1) on divide between Wainiha and Waimea rivers, Kauai, 1910–11.

[Elevation, 4,023 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
July 11 [a]	23	11.6	0.50	June 2	34	30.4	0.90
Aug. 19	39	10.4	.27	July 7	35	14.6	.42
Sept. 23	35	13.2	.38	Aug. 5	29	9.0	.31
Oct. 17	24	8.5	.35	Sept. 7	33	7.5	.23
Nov. 20	34	16.2	.48	Oct. 13	36	26.4	.73
1911.				Nov. 11	29	5.0	.17
Feb. 18	90	[b] 51.6+	.....	Dec. 27	46	31.0	.67
Mar. 24	34	17.8	.52	June 18, 1910, to Dec. 27, 1911	557	275.8+	.50+
Apr. 29	36	22.6	.63				

[a] Gage installed June 18, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

[1] Evaporation station.

Rainfall at Lehuamakanoi (station No. 2), Waimea River drainage basin, Kauai, 1910–11.

[Elevation, 3,932 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
July 11 [a]	23	4.2	0.18	June 2	34	14.8	0.44
Aug. 19	39	4.5	.12	July 7	35	6.0	.17
Sept. 23	35	7.5	.21	Aug. 5	29	3.8	.13
Oct. 17	24	4.7	.20	Sept. 7	33	2.0	.06
Nov. 20	34	14.4	.42	Oct. 13	36	10.0	.28
				Nov. 11	29	2.7	.09
1911.				Dec. 27	46	18.2	.40
Feb. 18	90	[b] 51.6+	.....				
Mar. 24	34	14.4	.42	June 18, 1910, to Dec. 27, 1911	557	176.2+	.32+
Apr. 29	36	17.4	.48				

[a] Gage installed June 18, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Paukahana (station No. 3), Waimea River basin, Kauai, 1910–11.

[Elevation, 3,723 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
July 11 [a]	37	4.7	0.13	May 19	7	2.4	0.34
Aug. 27	47	3.3	.07	May 26	7	1.4	.20
Sept. 17	21	4.0	.19	June 2	7	2.8	.40
Oct. 17	30	4.5	.15	June 9	7	.6	.09
				June 16	7	.3	.04
June 4 to Oct. 17, 1910	135	16.5	.12	June 23	7	.4	.06
				June 30	7	.6	.09
1911.				July 7	7	.8	.11
				July 14	7	.5	.07
Jan. 6	.....	[b] 13.6	.....	July 21	7	.2	.03
Jan. 13	7	7.4	1.06	July 28	7	2.2	.31
Jan. 30	17	7.6	.45	Aug. 18	21	.4	.02
Feb. 18	19	10.8	.57	Aug. 25	7	.5	.07
Feb. 25	7	2.0	.29	Sept. 1	7	.3	.04
Mar. 11	14	2.2	.16	Sept. 9	8	1.0	.12
Mar. 18	7	2.4	.34	Sept. 15	6	.4	.07
Mar. 24	6	2.4	.40	Sept. 22	7	1.6	.23
Apr. 1	8	4.4	.55	Sept. 29	7	1.9	.27
Apr. 8	7	.2	.03	Oct. 13	14	1.2	.09
Apr. 15	7	.0	.00	Nov. 13	31	2.2	.07
Apr. 23	8	1.0	.12	Dec. 28	45	10.0	.22
Apr. 29	6	4.2	.70				
May 6	7	.2	.03	Jan. 6 to Dec. 28, 1911	356	77.7	.22
May 12	6	1.2	.20				

[a] Gage installed June 4, 1910.
[b] Small tube in receiver stopped with dirt so water could not enter container. Receiver overflowed.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Mohihi-Koaie divide (station No. 4), Waimea River drainage basin, Kauai, 1910–11.

[Elevation, 3,950 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
July 12 [a]	18	2.3	0.13	Apr. 22	36	9.8	0.27
Aug. 16	35	2.8	.08	June 3	42	14.8	.35
Sept. 14	29	3.7	.13	July 8	35	5.0	.14
Oct. 16	32	4.9	.15	Oct. 13	97	10.0	.10
Nov. 19	34	15.6	.46	Nov. 12	30	2.6	.09
1911.				Dec. 28	46	11.8	.26
Feb. 17	90	[b] 51.6+	.....	June 24, 1910, to Dec. 28, 1911	552	143.1+	.26+
Mar. 17	28	8.2	.29				

[a] Gage installed June 24, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Mohihi Upper Crossing (station No. 5), Waimea River drainage basin, Kauai, 1910–11.

[Elevation, 3,500 feet.]

Date of observation.	Period (days).	Recorded rainfall		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
July 12 [a]	21	2.5	0.12	June 3	42	14.0	0.33
Aug. 16	35	2.1	.06	July 8	35	5.7	.16
Sept. 14	29	4.5	.16	Aug. 5	28	3.1	.11
Oct. 16	32	5.8	.18	Oct. 13	69	9.9	.14
Nov. 19	34	14.8	.44	Nov. 12	30	2.6	.09
1911.				Dec. 28	46	10.2	.22
Feb. 17	90	[b] 51.6+	.....	June 21, 1910, to Dec. 28, 1911	555	143.8+	.26+
Mar. 17	28	8.0	.29				
Apr. 22	36	9.0	.25				

[a] Gage installed June 21, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Waiakoali Camp (station No. 6), Waimea River drainage basin, Kauai, 1910–11.

[Elevation, 3,450 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
July 10 [a]	36	5.7	0.16	May 19	7	2.2	0.31
Aug. 23	44	3.0	.07	26	7	1.2	.17
Sept. 16	24	4.2	.17	June 2	7	2.6	.37
Oct. 8	22	5.2	.24	9	7	.6	.09
				16	7	.4	.06
June 4 to Oct. 8, 1910	126	18.1	.14	23	7	.5	.07
				30	7	.5	.07
1911.				July 7	7	.7	.10
Jan. 6		[b] 13.8+		14	7	.4	.06
13	7	8.2	1 17	21	7	.4	.06
30	17	8.1	.48	28	7	2.2	.31
Feb. 17	18	10.2	.57	Aug. 18	21	.3	.01
25	8	2.2	.28	25	7	.5	.07
Mar. 10	13	2.6	.20	Sept. 1	7	.3	.04
17	7	3.0	.43	9	8	.8	.10
25	8	3.0	.38	15	6	.4	.07
Apr. 1	7	5.0	.71	22	7	1.8	.26
7	6	.4	.07	29	7	2.0	.29
14	7	.0	.00	Oct. 13	14	1.2	.09
22	8	.5	.06	Nov. 12	30	1.8	.06
28	6	5.8	.97	Dec. 27	45	10.0	.22
May 5	7	.6	.09				
12	7	1.6	.23	Jan. 6 to Dec. 27, 1911	355	82.0	.23

[a] Gage installed June 4, 1910.
[b] Small tube in receiver stopped by leaves so water could not enter container. Receiver overflowed.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Kokee (station No. 7), Waimea River drainage basin, Kauai, 1910–11.

[Elevation, 3,550 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Aug. 27 [a]	82	[b] 5.6	0.07	May 19	7	1.4	0.20
Sept. 9	13	[b] 1.4	.11	26	7	1.0	.16
24	15	4.4	.29	June 2	7	2.8	.40
Oct. 15	21	1.6	.08	9	7	.4	.06
Nov. 24 [c]	40			16	7	.0	.00
				30	14	.3	.02
1911.				July 7	7	.3	.04
Jan. 6	43	17.0	.40	21	14	.2	.01
13	7	6.5	.93	28	7	2.4	.34
30	17	6.3	.37	Aug. 18	21	.2	.01
Feb. 18	19	5.6	.29	25	7	.6	.09
25	7	2.2	.31	Sept. 9	15	.7	.05
Mar. 11	14	2.4	.17	15	6	.1	.02
18	7	3.4	.49	22	7	.8	.11
25	7	3.0	.43	29	7	1.5	.21
Apr. 1	7	4.0	.57	Oct. 14	15	.5	.03
8	7	.4	.06	Nov. 11	28	2.2	.08
15	7	.0	.00	Dec. 28	47	4.8	.10
23	8	.6	.08				
29	6	2.2	.37	June 6, 1910, to Dec. 28, 1911 [d]	531	87.5	.16
May 6	7	.0	.00				
12	6	.7	.12				

[a] Gage installed June 16, 1910.
[b] Reading of doubtful accuracy.
[c] Gage was found to have been disturbed by cattle.
[d] Period of 40 days, Oct. 15 to Nov. 24, 1910, no record obtained.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Puu Lua (station No. 8), near Waimea Canyon, Kauai, 1910–11.

[Elevation, 3,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910				1911.			
July 6 [a]	31	2.8	0.09	May 6	7	0.0	0.00
Aug. 27	52	1.6	.03	12	6	.6	.10
Sept. 13	17	2.6	.15	19	7	.4	.06
24	11	4.5	.41	26	7	.8	.11
Oct. 15	21	.4	.02	June 2	7	2.0	.29
				9	7	.0	.00
June 5 to Oct. 15, 1910	132	11.9	.09	16	7	.2	.03
				30	14	.2	.01
1911.				July 28	28	2.6	.09
Jan. 30 [b]				Aug. 18	21	.2	.01
Feb. 18	19	2.2	.12	25	7	.6	.09
25	7	4.6	.65	Sept 15	21	.2	.01
Mar. 11	14	2.6	.19	22	7	.9	.13
18	7	3.0	.43	29	7	1.4	.20
25	7	2.0	.29	Oct. 14	15	.4	.03
Apr. 1	7	4.0	.57	Nov. 11	28	2.0	.07
8	7	.6	.09	Dec. 28	47	1.4	.03
15	7	.0	.00				
23	8	.4	.05	Jan. 30 to Dec. 28, 1911	332	33.7	.10
29	6	.4	.07				

[a] Gage installed June 5, 1910.
[b] Gage was found to have been disturbed by cattle. No record obtained.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Waialae River gaging station (station No. 9), Waimea River drainage basin, Kauai, 1910–11.

[Elevation, 3,600 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Aug. 31 [a]	31	1.8	0.58	June 27	34	4.4	0.13
Sept. 30	30	5.6	.19	Aug. 3	37	4.6	.12
Nov. 10	41	14.8	.36	Sept. 12	40	2.7	.07
Dec. 1	21	[b] .64	.03	Oct. 16	34	6.0	.18
				Nov. 17	32	4.2	.13
1911.							
Jan. 3	33	10.8	.33	1912.			
Feb. 4	32	22.4	.70	Jan. 4	48	9.2	.19
23	19	14.4	.76				
Mar. 6	11	9.4	.85	July 31, 1910, to Jan. 4, 1912	522	[c] 124.3	.24
Apr. 5	30	8.4	.28				
May 24	49	5.0	.10				

[a] Gage installed July 31, 1910.
[b] Reading doubtful. Very likely should be 6.4 inches.
[c] If reading Dec. 1 was 6.4 inches, this would be 130.1 inches, or 0.25 inch per day.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Keanakua (station No. 10), on divide between Makuone Stream and Waialae River, Kauai, 1910–11.

[Elevation, 4,450 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Oct. 5[a]	29	7.0	0.24	Sept. 12	41	4.7	0.11
Nov. 22	48	18.7	.39	Oct. 17	35	10.0	.29
1911.				Nov. 17	31	5.3	.17
Feb. 22	92	[b] 51.6+	.....	1912.			
Mar. 7	13	9.0	.69	Jan. 5	49	13.4	.27
Apr. 5	29	9.6	.33				
May 24	49	11.0	.22	Sept. 6, 1910, to Jan. 5, 1912	486	153.2+	.32+
June 27	34	7.3	.21				
Aug. 2	36	5.6	.16				

[a] Gage installed Sept. 6, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Kahana-Makuone divide (station No. 11), Makaweli River drainage basin, Kauai, 1910–11.

[Elevation, 3,750 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Aug. 30[a]	30	3.4	0.11	Aug. 1	36	5.4	0.15
Oct. 6	36	7.9	.22	Sept. 11	41	4.7	.11
Nov. 23	48	15.6	.33	Oct. 16	35	8.0	.23
1911.				Nov. 16	31	4.6	.15
Feb. 22	91	[b] 51.6+	.....	1912.			
Mar. 8	14	8.8	.63	Jan. 5	50	13.2	.26
Apr. 4	27	6.4	.24				
May 23	49	8.6	.18	Aug. 1, 1910, to Jan. 5, 1912	522	143.0+	.27+
June 26	34	4.8	.14				

[a] Gage installed Aug. 1, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall on Waialeale Mountain (station No. 12), Kauai, 1910–11.

[Elevation, 5,080 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Oct. 5[a]	28	31.2	1.11	Aug. 2[c]	.....	[d] 51.6+	.....
Nov. 22	48	34.3	.72	Oct. 17	6	[d] 125 +	1.6 +
1911.				1912.			
Jan. 3[b]	.....	.....	.....	Jan. 6	81	86.0	1.06

[a] Special gage, 50-inch capacity, installed Sept. 7, 1910.
[b] No reliable records, and it is probable that gage was not visited until Aug. 2, 1911, when it was found to have overflowed.
[c] Gage replaced by one of 125-inch capacity.
[d] Gage overflowed.

Rainfall at Olokele mauka (station No. 13), Makaweli River drainage basin, Kauai, 1911.

[Elevation, 2,100 feet.]

	Recorded rainfall (inches).		Recorded rainfall (inches).
April	7.63	October	4.37
May	9.35	November	12.52
June	8.85	December	13.24
July	7.50		
August	4.18	Apr. 1 to Dec. 31	86.10
September	18.46	Mean daily	0.313

NOTE.—Record furnished by Hawaiian Sugar Co., Makaweli, Kauai.

Rainfall at Olokele ditch (station No. 14), Makaweli River drainage basin, Kauai, 1910–11.

[Elevation, 1,310 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	13.34	25.86	September	6.05	13.00
February	.97	16.50	October	9.29	.89
March	6.38	8.94	November	13.53	28.62
April	6.57	6.35	December	12.48	10.00
May	6.95	5.46			
June	9.37	6.11	Annual	93.22	110.81
July	4.11	5.13	Mean daily	.255	.304
August	4.18	1.95			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Mana pump (station No. 15), Kauai, 1910–11.

[Elevation, 30 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	1.36	5.52	September	3.81	1.62
February	.37	2.12	October	3.85	.43
March	.08	8.04	November	.10	.29
April	.56	.43	December	2.01	.10
May	.71	1.04			
June	1.36	.22	Annual	14.35	21.43
July	.14	1.62	Mean daily	.039	.059
August	(a)	(a)			

a Trace of rain, but too small to measure.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waiawa (station No. 16), Kauai, 1910–11.

[Elevation, 30 feet.]

Month.	1910	1911	Average, 17 years.	Month.	1910	1911	Average, 17 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	1.15	5.42	2.92	September	4.19	2.87	1.31
February	.24	2.78	3.53	October	1.26	.79	.91
March	.03	4.22	4.41	November	5.10	.00	3.06
April	.60	.28	.74	December	2.61	.13	2.66
May	.80	1.79	.92				
June	1.51	.16	.43	Annual	17.72	20.99	22.09
July	.23	2.55	.48	Mean daily	.049	.057	.060
August	.00	(a)	.72				

a Trace of rain, but too small to measure.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kekaha (station No. 17), Kauai, 1910–11.

[Elevation, 40 feet.]

Month.	1910	1911	Average, 20 years.	Month.	1910	1911	Average, 20 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	1.50	5.98	3.30	September	2.85	2.66	1.12
February	.07	1.74	3.63	October	2.11	1.32	1.20
March	.09	4.33	4.14	November	4.79	.06	2.64
April	.83	.25	.92	December	1.98	.30	2.76
May	.50	2.00	1.02				
June	1.63	.16	.32	Annual	16.81	22.04	22.64
July	.22	2.84	.45	Mean daily	.046	.060	.062
August	.24	.40	1.14				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at camp No. 7 (station No. 18) near Waimea, Kauai, 1904–1911.

[Elevation, 150 feet.]

Month.	1904	1905	1906	1907	1908	1909	1910	1911	Average 8 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	1.33	0.43	3.80	18.12	0.80	3.19	0.30	7.98	4.49	18.12	0.30
February	17.50	.31	.19	2.67	1.76	1.11	.10	2.52	3.27	17.50	.10
March	5.50	.28	1.23	4.76	13.60	10.57	.70	4.18	5.10	13.60	.28
April	.00	.00	.85	.45	.38	.78	.61	.25	.42	.85	.00
May	.00	.00	.47	2.40	.00	.00	.56	.22	.46	2.40	.00
June	.00	.63	.00	.63	.02	.04	.96	.07	.29	.96	.00
July	.15	.95	.50	.00	.08	.30	.73	2.45	.64	2.45	.00
August	2.30	.65	1.65	.43	.09	.00	.00	.56	.71	2.30	.00
September	2.24	.25	.15	.00	.26	.20	1.74	2.34	.90	2.34	.00
October	.00	.85	1.25	1.00	.27	1.70	1.49	.48	.88	1.70	.00
November	.50	7.25	2.30	.19	.00	.00	5.33	.11	1.96	7.25	.00
December	2.28	.00	5.76	.80	.01	10.64	1.73	.58	2.72	10.64	.00
Annual	31.80	11.60	18.15	31.45	17.27	28.53	14.25	21.74	21.85	31.80	11.60
Mean daily	.087	.032	.050	.086	.047	.078	.039	.060	.060	.086	.032

NOTE.—Records furnished by Hawaiian Sugar Co., Makaweli, Kauai.

Rainfall at Hiloa-Hanapepe divide (station No. 19), Hanapepe River drainage basin, Kauai, 1910–11.

[Elevation, 2,080 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Aug. 31[a]	7	4.2	0.60	May 31	31	17.0	0.55
Sept. 30	30	10.8	.36	June 30	30	25.4	.85
Oct. 31	31	18.3	.59	July 31	31	14.2	.46
Nov. 30	30	20.6	.69	Aug. 31	31	12.7	.41
Dec. 31	31	19.6	.63	Sept. 30	30	41.6	1.39
1911.				Oct. 31	31	7.0	.23
Jan. 31	31	43.1	1.39	Nov. 30	30	17.6	.59
Feb. 28	28	24.0	.86	Dec. 31	31	20.1	.65
Mar. 31	31	9.9	.32	Aug. 24, 1910, to Dec. 31, 1911	494	322.7	.65
Apr. 30	30	16.6	.56				

[a] Gage installed Aug. 24, 1910.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall in Hanapepe Valley, one-half mile below Hanapepe Falls (station No. 20), Hanapepe River drainage basin, Kauai, 1905–1911.

[Elevation, 510 feet.]

Month.	1905	1906	1907	1908	1909	1910	1911	Average 7 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	0.60	7.35	38.85	3.85	8.95	16.13	29.21	14.99	38.85	0.60
February	.00	1.65	10.10	9.35	7.80	3.08	18.70	7.24	18.70	.00
March	4.90	2.90	30.25	26.80	37.65	17.38	8.87	18.39	37.65	2.90
April	4.20	4.50	6.35	13.30	37.85	12.66	7.31	12.31	37.85	4.20
May	8.30	8.00	5.60	11.20	5.83	9.11	7.19	7.89	11.20	5.60
June	2.20	5.40	11.80	8.45	13.22	16.17	10.96	9.74	16.17	2.20
July	4.20	9.10	17.30	6.20	17.31	7.11	8.08	9.90	17.31	4.20
August	19.20	17.70	31.05	12.95	11.50	10.93	4.49	15.40	31.05	4.49
September	8.70	6.80	6.40	7.80	9.93	8.88	20.42	9.85	20.42	6.40
October	12.30	9.70	4.75	8.70	8.76	10.93	3.53	8.38	12.30	3.53
November	13.98	10.60	13.35	.60	3.04	14.61	9.64	9.40	14.61	.60
December	6.60	16.50	11.20	7.10	24.80	14.31	11.48	13.14	24.80	6.60
Annual	85.18	100.20	187.00	116.30	186.64	141.30	139.88	135.21	187.00	85.18
Mean daily	.23	.27	.51	.32	.51	.39	.38	.37	.51	.23

NOTE.—Records furnished by Hawaiian Sugar Co., Makaweli, Kauai.

Rainfall at Makaweli (station No. 21), Kauai, 1910–11.

[Elevation, 140 feet.]

Month.	1910	1911	Average 16 years.	Month.	1910	1911	Average 16 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	1.48	8.77	2.88	September	3.99	2.39	1.20
February	.29	4.62	3.44	October	1.48	1.10	1.25
March	.66	3.99	5.07	November	7.22	.95	2.58
April	1.32	.36	.67	December	2.48	1.17	2.91
May	.93	1.02	.98				
June	1.87	.66	.52	Annual	23.00	28.31	22.91
July	.98	3.00	.72	Mean daily	.063	.078	.063
August	.30	.28	.69				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at camp No. 2 (station No. 22) near Hanapepe, Kauai, 1905–1911.

[Elevation, 250 feet.]

Month.	1905	1906	1907	1908	1909	1910	1911	Average 7 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	0.25	4.60	19.65	0.03	4.94	2.57	11.26	6.19	19.65	0.03
February	.00	.00	1.65	2.53	1.87	.07	4.47	1.51	4.47	.00
March	.00	.97	10.67	13.17	14.37	.40	4.14	6.25	14.37	.00
April	.20	.56	.03	1.27	2.07	1.91	.34	.91	2.07	.03
May	.00	.22	2.90	.24	.08	1.05	.95	.78	2.90	.00
June	.20	.00	.30	.51	.57	1.47	.30	.48	1.47	.00
July	.00	.28	2.23	.26	.10	.68	3.58	1.02	3.58	.00
August	.70	2.75	1.44	.26	.26	.00	.35	.82	2.75	.00
September	.60	1.54	.72	.54	.80	2.64	4.13	1.57	4.13	.60
October	1.45	.80	.06	1.82	3.00	1.72	.63	1.35	3.00	.06
November	7.00	2.57	.64	.00	.00	8.92	.90	2.86	8.92	.00
December	.00	4.25	.64	.22	9.40	3.50	2.04	2.86	9.40	.00
Annual	10.40	18.54	40.93	20.85	37.46	24.93	33.09	26.20	40.93	10.40
Mean daily	.028	.051	.112	.057	.103	.068	.091	.073	.112	.028

NOTE.—Records furnished by Hawaiian Sugar Co., Makaweli, Kauai.

Rainfall at Eleele (station No. 23), Kauai, 1910–11.

[Elevation, 150 feet.]

Month.	1910	1911	Average 11 years.	Month.	1910	1911	Average 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	1.86	8.96	3.94	September	1.62	2.98	1.66
February	.48	3.41	4.24	October	1.97	.52	1.46
March	1.05	4.55	5.95	November	7.21	.97	2.52
April	1.74	.49	1.40	December	3.86	1.27	2.45
May	.76	.33	1.14				
June	1.44	.53	1.06	Annual	23.74	26.59	28.26
July	1.12	2.18	1.20	Mean daily	.065	.073	.077
August	.63	.40	1.24				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Wahiawa mauka (station No. 24), Wahiawa Stream drainage basin, Kauai, 1910–11.

[Elevation, 2,000 feet.]

Month.	1910	1911	Average 11 years.	Month.	1910	1911	Average 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	.....	38.75	14.24	September	10.35	33.20	12.76
February	3.75	22.25	16.17	October	15.25	6.30	13.91
March	15.05	9.30	18.85	November	15.50	11.10	13.71
April	16.75	10.37	12.73	December	13.20	16.00	14.61
May	10.25	13.40	11.55				
June	26.75	16.10	12.55	Annual	.....	204.52	171.02
July	8.50	17.00	12.58	Mean daily	[a].45	.56	.47
August	15.50	10.75	17.36				

[a] For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at McBryde residence (station No. 25), Wahiawa Stream drainage basin, Kauai, 1910–11.

[Elevation, 900 feet.]

Month.	1910	1911	Average 11 years.	Month.	1910	1911	Average 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	5.90	20.15	8.09	September	5.56	14.06	5.16
February	1.16	9.98	6.74	October	5.12	1.36	4.70
March	5.39	4.57	10.19	November	12.88	5.48	5.97
April	6.76	3.91	4.80	December	5.51	6.55	6.36
May	3.75	3.04	3.22				
June	8.74	5.84	4.26	Annual	69.34	83.66	70.31
July	4.30	6.01	4.94	Mean daily	.190	.229	.193
August	4.27	2.71	5.88				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Wahiawa (station No. 26), Wahiawa Stream drainage basin, Kauai, 1910–11.

[Elevation, 225 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	2.51	8.69	September	2.17	3.97
February	.60	5.92	October	1.99	1.00
March	1.80	3.69	November	7.68	1.33
April	2.48	1.03	December	3.91	2.34
May	.71	1.17			
June	2.11	1.51	Annual	29.11	35.16
July	1.36	4.03	Mean daily	.080	.096
August	1.79	0.48			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Homestead (station No. 27), Lawai Stream drainage basin, Kauai, 1910–11.

[Elevation, 631 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	16.26	September	4.35	11.07
February	.....	8.21	October	4.11	1.65
March	.....	3.90	November	10.17	3.24
April	.....	2.51	December	6.90	5.32
May	3.30	2.44			
June	5.74	4.78	Annual	.....	66.44
July	4.55	5.33	Mean daily	.174	.182
August	3.48	1.73			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at East Lawai (station No. 28), Lawai Stream drainage basin, Kauai, 1910–11.

[Elevation, 600 feet.]

Month.	1910	1911	Average 10 years.	Month.	1910	1911	Average 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.70	14.07	.....	September	7.39	11.73	5.96
February	1.33	11.50	.....	October	4.83	1.56	5.12
March	5.40	3.67	.....	November	11.58	2.84	3.44
April	7.07	2.84	5.49	December	8.03	4.83	6.41
May	5.43	4.88	4.25				
June	6.96	5.72	4.70	Annual	73.91	72.77	.....
July	5.02	6.10	4.89	Mean daily	.205	.199	.....
August	6.17	3.03	7.47				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Lawai (government road, station No. 29), Kauai, 1910.

[Elevation, 450 feet.]

	Inches.		*Inches.*
January	4.34	September	6.28
February	3.84	October	12.31
March	4.86	November	14.07
April	6.55	December	5.71
May	4.93		
June	4.93	Annual	76.57
July	4.58	Mean daily	.210
August	4.17		

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Lawai (west, station No. 30), Kauai, 1910–11.

[Elevation, 225 feet.]

Month.	1910	1911	Average 10 years.	Month.	1910	1911	Average 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	2.83	11.81	4.69	September	4.15	6.08	3.22
February	.26	6.72	4.07	October	2.71	2.16	2.66
March	2.55	4.26	7.04	November	11.18	1.23	3.58
April	3.38	1.39	2.20	December	4.52	2.32	3.90
May	1.47	2.84	1.56				
June	2.86	2.62	1.84	Annual	39.15	47.32	39.89
July	1.06	4.44	2.08	Mean daily	.107	.130	.109
August	2.18	1.45	3.05				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Lawai Beach (station No. 31), Kauai, 1910–11.

[Elevation, 5 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.28	11.72	September	8.68	5.65
February	.69	7.70	October	2.83	1.21
March	2.60	3.51	November	12.02	1.18
April	2.25	1.28	December	3.04	2.01
May	1.52	3.66			
June	2.24	2.53	Annual	42.72	47.35
July	1.79	5.56	Mean daily	.117	.130
August	1.78	1.34			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Koloa (station No. 32), Kauai, 1910–11.

[Elevation, 241 feet.]

Month.	1910	1911	Average 25 years.	Month.	1910	1911	Average 25 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.21	12.48	5.85	September	7.65	11.16	4.22
February	1.35	10.78	5.92	October	5.01	2.05	5.02
March	5.10	4.86	7.69	November	11.76	3.08	6.23
April	6.75	2.19	4.25	December	7.39	4.38	5.74
May	4.47	6.83	4.67				
June	5.14	5.76	4.13	Annual	67.52	75.29	63.13
July	3.54	7.22	4.43	Mean daily	.185	.206	.173
August	5.15	4.50	4.98				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kukuiula (station No. 33), Kauai, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	1.66	11.23	September	3.75	4.01
February	.10	7.04	October	2.44	1.65
March	.98	3.70	November	11.92	1.05
April	2.36	.60	December	3.68	1.15
May	1.31	1.97			
June	1.81	1.83	Annual	33.56	39.23
July	2.22	4.25	Mean daily	.092	.107
August	1.33	.75			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Puuhi (station No. 34), Kauai, 1910–11.

[Elevation, 75 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	1.66	7.75	September	2.14	3.29
February	.00	3.94	October	1.07	1.05
March	.71	3.60	November	10.17	.17
April	.85	.50	December	2.90	.93
May	.64	.70			
June	1.28	.64	Annual	22.41	26.07
July	.62	3.50	Mean daily	.061	.071
August	.37	.00			

NOTE.—Compiled from United States Weather Bureau records.

Rainfall at Mahaulepu (station No. 35), Kauai, 1910–11.

[Elevation, 90 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.10	14.36	September	3.57	8.54
February	1.09	7.95	October	4.47	2.14
March	1.70	6.12	November	11.20	1.93
April	4.55	1.71	December	6.91	3.82
May	4.25	3.60			
June	3.27	4.38	Annual	48.28	64.78
July	1.89	7.19	Mean daily	.132	.177
August	2.28	3.04			

NOTE.—Compiled from United States Weather Bureau records.

Rainfall at Kamoola ditch (station No. 36), Huleia River drainage basin, Kauai, 1910–11.

[Elevation, 835 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	11.53	16.01	September	8.39	22.74
February	3.46	7.02	October	9.60	3.63
March	8.32	7.27	November	14.12	5.53
April	10.72	5.04	December	7.74	7.87
May	9.34	11.15			
June	14.49	9.34	Annual	114.58	113.63
July	9.13	9.30	Mean daily	.314	.311
August	7.74	8.73			

NOTE.—Compiled from United States Weather Bureau records.

Rainfall at Wilcox ditch (station No. 37), Huleia River drainage basin, Kauai, 1910–11.

[Elevation, 725 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	5.87	16.33	September	10.72	15.57
February	1.81	11.82	October	6.64	2.30
March	6.00	6.84	November	13.24	4.31
April	7.99	4.06	December	7.18	6.39
May	5.66	6.32			
June	7.10	6.63	Annual	83.72	91.71
July	5.02	7.19	Mean daily	.229	.251
August	6.49	3.95			

NOTE.—Compiled from United States Weather Bureau records.

Rainfall at Aakukui (station No. 38), Huleia River drainage basin, Kauai, 1909–1911.

[Elevation, 350 feet.]

Month.	1909	1910	1911	Month.	1909	1910	1911
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	.....	3.40	12.80	September	2.35	7.95	9.51
February	.....	1.58	7.85	October	4.27	6.24	1.98
March	.....	4.14	5.56	November	1.35	13.13	3.30
April	.....	5.33	1.27	December	10.81	4.49	3.51
May	.....	3.74	4.87				
June	2.65	4.68	3.99	Annual	.....	62.28	63.51
July	3.95	3.43	5.44	Mean daily	[a] 129	.171	.173
August	2.31	4.17	3.43				

[a] For 7 months.

NOTE.—Records furnished by E. H. W. Broadbent, manager Grove Farm plantation, Lihue, Kauai.

Rainfall at Kukaua (station No. 39), Kilohana crater, Kauai, 1910–11.

[Elevation, 1,000 feet.]

Month.	1910	1911	Average 12 years.	Month.	1910	1911	Average 12 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.80	21.34	7.77	September	6.68	15.60	6.72
February	2.91	8.95	8.33	October	12.14	2.78	8.20
March	5.81	8.20	11.47	November	16.31	6.90	8.14
April	7.78	4.23	7.76	December	7.88	6.90	9.37
May	8.18	9.21	7.06				
June	7.64	8.01	5.93	Annual	92.94	105.43	96.38
July	5.06	7.68	6.97	Mean daily	.255	.289	.264
August	5.75	5.63	8.66				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Lihue (Kilohana) (station No. 40), Nawiliwili Stream drainage basin, Kauai, 1910–11.

[Elevation, 400 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.53	14.14	September	4.05	7.78
February	1.88	6.66	October	7.03	1.64
March	2.37	7.16	November	14.49	3.90
April	3.96	1.56	December	3.54	2.42
May	5.23	3.19			
June	3.75	3.17	Annual	55.35	59.28
July	2.64	4.79	Mean daily	.152	.162
August	2.88	2.87			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Molokoa (station No. 41), Nawiliwili Stream drainage basin, Kauai, 1910–11.

[Elevation, 250 feet.]

Month.	1910	1911	Average 19 years.	Month.	1910	1911	Average 19 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	3.25	14.15	4.78	September	2.44	6.92	2.88
February	1.70	5.95	5.51	October	5.67	1.63	4.55
March	2.32	7.87	7.13	November	13.90	3.90	5.95
April	3.62	1.16	3.30	December	3.95	2.71	5.53
May	4.26	3.13	3.29				
June	3.93	3.49	2.77	Annual	50.01	57.64	52.57
July	2.73	4.08	2.80	Mean daily	.137	.158	.144
August	2.24	2.65	4.08				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Grove Farm (station No. 42), Nawiliwili Stream drainage basin, Kauai, 1910–11.

[Elevation, 200 feet.]

Month.	1910	1911	Average 27 years.	Month.	1910	1911	Average 27 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.38	12.75	4.62	September	2.51	6.65	2.76
February	2.33	6.57	5.20	October	5.26	1.90	3.62
March	1.99	6.17	6.15	November	12.19	2.98	5.50
April	3.07	.87	3.14	December	4.79	2.34	4.86
May	2.83	2.19	3.08				
June	2.60	2.47	1.99	Annual	45.85	51.04	45.86
July	1.77	4.17	2.21	Mean daily	.126	.140	.126
August	2.13	1.98	2.73				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Lihue (station No. 43), Nawiliwili Stream drainage basin, Kauai, 1910–11.

[Elevation, 200 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.93	13.54	September	2.97	6.73
February	2.32	5.53	October	5.18	2.11
March	2.29	6.71	November	14.61	3.51
April	2.68	1.14	December	4.12	2.76
May	3.76	2.20			
June	2.98	2.20	Annual	49.68	52.97
July	2.74	4.22	Mean daily	.136	.145
August	2.10	2.32			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hanamaula (station No. 44), Hanamaula Stream drainage basin, Kauai, 1910–11.

[Elevation, 200 feet.]

Month.	1910	1911	Average 17 years.	Month.	1910	1911	Average 17 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.45	14.78	4.73	September	2.50	6.20	2.77
February	1.76	8.05	5.20	October	4.53	2.41	3.65
March	2.19	3.95	6.69	November	13.05	5.71	5.13
April	2.77	.79	2.36	December	4.06	2.79	4.84
May	2.55	1.27	2.26				
June	2.51	2.54	2.37	Annual	44.22	51.84	45.02
July	1.97	2.85	2.09	Mean daily	.121	.142	.123
August	1.88	.50	2.93				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waiahi (station No. 45), Wailua River drainage basin, Kauai, 1910–11.

[Elevation, 600 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Sept. 23[a]	27	6.5	0.24	June 29	29	10.2	0.35
Oct. 26	33	9.0	.27	July 31	32	9.4	.29
Nov. 22	27	23.8	.88	Aug. 30	30	6 8	.23
Dec. 25	33	8.6	.26	Sept. 29	30	21.0	.70
1911.				Oct. 31	32	4.4	.14
Jan. 27	33	26.6	.81	Nov. 30	30	8.2	.27
Feb. 27	31	17.6	.57	Dec. 30	30	11.2	.37
Mar. 28	29	9.2	.32	Aug. 27, 1910, to Dec. 30, 1911	490	191.7	.39
Apr. 30	33	6.6	.20				
May 31	31	12.6	.41				

[a] Gage installed Aug. 27, 1910.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Hanahanapuni (station No. 46), Wailua River drainage basin, Kauai, 1910–11.

[Elevation, 911 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Sept. 22[a]	26	5.5	0.21	June 30	31	9.2	0.30
Oct. 24	32	8.5	.27	July 31	31	7.2	.23
Nov. 23	30	12.2	.41	Aug. 31	31	6.4	.21
Dec. 23	30	4.4	.15	Sept. 30	30	17.6	.59
1911.				Oct. 31	31	3.0	.10
Jan. 28	36	34.0	.95	Nov. 30	30	7.6	.25
Feb. 28	31	10.8	.35	Dec. 30	30	8.2	.27
Mar. 29	29	7.8	.27	Aug. 27, 1910, to Dec. 30, 1911	490	160.2	.33
Apr. 30	32	5.6	.18				
May 30	30	12.2	.41				

[a] Gage installed Aug. 27, 1910.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Summit Camp (station No. 47), on divide between Hanalei River and North Fork of Wailua River, Kauai, 1910–11.

[Elevation, 1,900 feet.]

Month.	1910	1911	Month.	1910	1911
January		30.14	September	[a] 10.61	28.76
February		22.73	October	21.98	7.05
March		16.91	November	24.22	13.53
April		12.16	December	15.12	22.45
May		22.70			
June		15.10	Annual		214.01
July		13.20	Mean daily	[b] .68	.59
August		9.28			

[a] Sept. 18–30, 1910.

[b] Sept. 18 to Dec. 31, 1910.

NOTE.—Observations made daily by Kauai Electric Co.

Rainfall at Kapehuala (station No. 48), on divide between North Fork of Wailua River and Kapaa River, Kauai, 1910–11.

[Elevation, 3,130 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Sept. 11 [a]	46	22.8	0.50	Oct. 16	67	49.6	0.67
1911.				Dec. 29	74	[b]51.6+	.....
Feb. 27	169	[b]51.6+	.....	July 27, 1910, to Dec. 29, 1911	520	278.8+	.54+
May 21	83	[b]51.6+	.....				
Aug. 10	81	[b]51.6+	.....				

[a] Gage installed July 27, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Pohakupili (station No. 49), Kapaa River drainage basin, Kauai, 1910–11.

[Elevation, 2,589 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Aug. 8 [a]	14	3.2	0.23	Aug. 14	10	2.6	0.26
Sept. 25	48	18.3	.38	Oct. 11	58	26.0	.45
Nov. 4	40	24.8	.62	Dec. 27	77	47.8	.62
1911.				July 25, 1910, to Dec. 27, 1911	520	221.7+	.43+
May 19	196	[b]51.6+	.....				
Aug. 4	77	47.4	.62				

[a] Gage installed July 25, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Pueo (station No. 50), on divide between Anahola, Kealia, and Kalihiwai rivers, Kauai, 1910–11.

[Elevation, 2,748 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Aug. 8 [a]	14	6.4	0.46	Aug. 14	87	[b]51.6+	.....
Sept. 25	48	29.0	.61	Oct. 11	58	46.	0.79
Nov. 14	50	38.8	.78	Dec. 27	77	[b]51.6+	.....
1911.				July 25, 1910, to Dec. 27, 1911	520	275.5+	.53+
May 19	186	[b]51.6 -	.....				

[a] Gage installed July 25, 1910. [b] Gage overflowed.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Kapahi (station No. 51), Kapaa River drainage basin, Kauai, 1910–11.

[Elevation, 300 feet.]

Month.	1910	1911	Average, 12 years.	Month.	1910	1911	Average, 12 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inhes.*	*Inches.*
January	6.37	10.59	5.40	September	5.45	c7.80	3.60
February	2.43	6.06	5.48	October	14.81	1.90	4.81
March	2.40	6.30	8.20	November	13.66	7.00	6.16
April	2.39	.77	3.11	December	5.17	3.98	7.11
May	5.00	4.30	3.72				
June	2.88	3.38	3.72	Annual	64.81	57.82	58.75
July	1.79	4.36	4.19	Mean daily	.178	.158	.161
August	2.46	1.38	3.25				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kealia (station No. 52), Kauai, 1910–11.

[Elevation, 15 feet.]

Month.	1910	1911	Average, 12 years.	Month.	1910	1911	Average, 12 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.14	10.83	4.22	September	4.59	5.92	2.32
February	2.19	4.63	4.89	October	9.28	2.27	3.76
March	1.17	6.21	7.04	November	11.07	1.22	3.65
April	1.38	.64	1.89	December	3.00	.92	4.44
May	2.33	1.95	2.34				
June	1.05	2.10	1.62	Annual	44.51	41.79	40.07
July	1.20	3.96	1.91	Mean daily	.122	.114	.110
August	1.11	1.14	1.99				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Halaula (station No. 53), Kauai, 1910–11.

[Elevation, 250 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	9.33	16.80	.....	September	7.00	11.05	.....
February	2.95	9.30	5.38	October	8.30	4.45	4.14
March	1.70	10.00	8.68	November	21.20	2.60	5.46
April	1.75	.85	2.38	December	5.65	3.25	7.24
May	4.10	2.50	2.28				
June	1.80	4.85	2.36	Annual	67.68	69.10	.....
July	.90	1.85	2.18	Mean daily	.185	.189	.....
August	3.00	1.60	.....				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kilauea (station No. 54), 1910–11.

[Elevation, 342 feet.]

Month.	1910	1911	Average, 27 years.	Month.	1910	1911	Average, 27 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	7.20	11.17	5.76	September	3.18	7.66	4.47
February	2.52	7.61	6.55	October	6.86	2.02	5.69
March	2.76	8.70	9.61	November	11.35	3.94	6.95
April	3.06	1.93	4.81	December	4.83	3.43	6.38
May	3.38	3.82	5.27				
June	4.17	4.16	4.02	Annual	56.57	61.51	69.28
July	4.51	3.45	4.76	Mean daily	.155	.168	.190
August	2.75	3.62	5.01				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kapaka (station No. 55) on divide between Hanalei and Kalihiwai rivers, Kauai, 1910–11.

[Elevation, 1,123 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	16.67	September	7.35	25.14
February	.....	13.25	October	13.12	3.55
March	.....	10.59	November	13.72	10.34
April	.....	5.88	December	13.25	10.51
May	.....	14.34			
June	.....	10.03	Annual	.....	142.57
July	.....	11.24	Mean daily	a.389	.391
August	.....	11.03			

a Sept. 1 to Dec. 31, 1910.

NOTE.—Observations made daily by Kauai Electric Co.

Rainfall at W. F. Sanborn's residence (station No. 56), Hanalei, Kauai, 1910–11.

[Elevation, 105 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	13.56	September	3.18	12.44
February	.....	8.53	October	11.02	2.14
March	4.67	8.30	November	10.30	5.14
April	4.91	3.52	December	7.09	7.07
May	5.24	6.97			
June	6.87	5.38	Annual	.....	83.65
July	4.52	5.23	Mean daily	a.203	.229
August	4.29	5.38			

a For 10 months.

NOTE.—Readings made daily. Records furnished by W. F. Sanborn, manager Princeville Plantation Co., Ltd., Hanalei, Kauai.

Rainfall at intake of Wainiha canal (station No. 57), Wainiha River drainage basin, Kauai, 1907–1911.

[Elevation, 700 feet.]

Month.	1907	1908	1909	1910	1911	Average 5 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	5.13	12.09	19.88	14.25	12.84	19.88	5.13
February	5.15	16.82	17.68	6.89	34.27	16.16	34.27	5.15
March	22.83	11.45	39.48	15.14	18.06	21.39	39.48	11.45
April	13.36	29.90	11.47	21.20	12.11	17.61	29.90	11.47
May	10.38	6.73	9.53	15.30	30.48	14.48	30.48	6.73
June	11.70	5.82	9.68	19.70	9.46	11.27	19.70	5.82
July	18.95	5.04	16.93	6.81	7.48	11.04	18.95	5.04
August	39.16	11.49	11.11	8.88	4.08	14.94	39.16	4.08
September	4.08	6.96	7.50	7.13	24.76	10.09	24.76	4.08
October	9.04	7.99	11.09	13.72	2.85	8.94	13.72	2.85
November	19.66	6.72	5.55	13.59	12.02	11.51	19.66	5.55
December	28.14	12.49	25.32	22.87	9.93	19.75	28.14	9.93
Annual	a 182.45	126.54	177.43	171.11	179.75	170.70	a 182.45	126.54
Mean daily	.55	.35	.48	.47	.49	.47	.55	.35

a For 11 months.

NOTE.—Records furnished by Kauai Electric Co.

Rainfall at power house of Kauai Electric Co. (station No. 58), Wainihi River drainage basin, Kauai, 1907–1911.

[Elevation, 125 feet.]

Month.	1907	1908	1909	1910	1911	Average 5 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	2.87	4.85	11.75	11.26	7.68	11.75	2.87
February	6.05	11.65	6.31	4.32	15.31	8.73	15.31	4.32
March	17.22	6.62	21.55	11.33	11.56	13.66	21.55	6.62
April	5.34	7.66	5.45	10.75	3.20	6.48	10.75	3.20
May	11.81	3.33	10.85	13.14	13.64	10.55	13.64	3.33
June	11.92	5.45	6.29	14.99	6.48	9.03	14.99	5.45
July	16.21	3.62	11.16	4.87	7.27	8.63	16.21	3.62
August	39.68	7.13	5.59	5.77	7.12	13.06	39.68	5.59
September	4.70	5.30	7.33	6.55	17.23	8.22	17.23	4.70
October	5.58	4.44	6.75	6.64	2.52	5.19	6.75	2.52
November	10.61	2.22	2.08	8.18	7.40	6.10	10.61	2.08
December	12.08	3.16	15.47	13.25	10.76	10.94	15.47	3.16
Annual	[a] 141.20	63.45	103.68	111.54	113.75	109.30	[a] 141.20	63.45
Mean daily	.42	.17	.28	.30	.31	.30	.17	.42

[a] For 11 months.

NOTE.—Records furnished by Kauai Electric Co.

Alphabetic list of rainfall stations on Island of Kauai.

Name.	No.	Elevation.	Name.	No.	Elevation.
		Feet.			*Feet.*
Aakukui	38	350	Lawai (west)	30	225
Camp No. 2, near Hanapepe	22	250	Lehuamakanoi	2	3,932
Camp No. 7, near Waimea	18	150	Lihue	43	200
Eleele	23	150	Lihue (Kilohana)	40	400
Grove Farm	42	200	Makaweli	21	140
Halaula	53	250	Mohihi-Koaie divide	4	3,950
Hanahanapuni	46	911	Mohihi, upper crossing	5	3,500
Hanamaulu	44	200	Mahaulepu	35	90
Hanapepe Valley	20	510	Mana pump	15	30
Hiloa-Hanapepe divide	19	2,080	McBryde residence	25	900
Homestead	27	631	Molokoa	41	250
Intake, Wainiha canal	57	700	Olokele ditch	14	1,310
Kahana-Makuone divide	11	3,750	Olokele mauka	13	2,100
Kamoola ditch	36	835	Paukahana	3	3,723
Kapahi	51	300	Pohakupili	49	2,589
Kapaka	55	1,123	Power house, Kauai Electric Co	58	125
Kapehuala	48	3,130	Pueo	50	2,747
Kealia [a]	52	15	Puuhi	34	75
Keanakua	10	4,450	Puu Lua [a]	8	3,500
Kekaha	17	40	Sanborn's residence	56	105
Kilauea	54	342	Summit camp	47	1,900
Kilohana	1	4,023	Wahiawa	26	225
Kokee	7	3,550	Wahiawa mauka	24	2,000
Koloa [a]	32	241	Waiahi	45	600
Kukaua	39	1,000	Waiakoali camp [a]	6	3,450
Kukuiula	33	100	Waialae	9	3,600
Lawai Beach	31	5	Waialeale	12	5,080
Lawai (east)	28	600	Waiawa [a]	16	30
Lawai (Government road)	29	450	Wilcox ditch	37	725

[a] Evaporation station.

RAINFALL RECORDS ON ISLAND OF OAHU.

Records were obtained at 47 rainfall stations on Oahu during 1910 and 1911. Of these stations, 21 were above 500 feet, 11 above 1,000 feet, and 3 above 2,000 feet in elevation.

The stations on the koolau (windward) side of the island were below the region of heaviest rainfall, which probably occurs on the

windward slopes at some distance below the summits of the mountains. The location of the stations is shown on Plate XII (at end of volume).

In the subjoined tables acknowledgment is made to the United States Weather Bureau for use of data collected by it, and to cooperating parties and observers.

Rainfall stations on Island of Oahu.

	Elevation (feet).		Elevation (feet).
1. Makapuu	570	24. Puuloa	15
2. Mount Olympus	2,450	25. Waimalu-uka	500
3. Waiamao	600	26. Waimalu	25
4. Manoa	300	27. Waiawa-Waiahole divide	
5. Tantalus (Isenberg)	1,650	28. Waiawa	675
6. Kaliula	1,200	29. Schofield Barracks	990
7. Rhodes' Gardens	300	30. Hoaeae [1]	725
8. United States Experiment Station	120	31. Waipahu	200
9. Spencer Street, Honolulu [1]	100	32. Ewa plantation	50
10. Kinau Street, Honolulu	50	33. Magnetic station (Coast and Geodetic Survey)	45
11. United States Weather Bureau	111	34. Waianae (mauka)	1,600
12. United States Naval Station	6	35. Waianae mill	6
13. Konahuanui	3,100	36. Kaala Gulch	1,700
14. Nuuanu Pali	1,200	37. Wahiawa	870
15. Luakaha, upper [1]	1,125	38. Waialua mill	30
16. Luakaha, lower	850	39. Kawaiiki	1,050
17. Electric light power station	405	40. Waialua (Opaeula)	1,100
18. Wyllie Street, Honolulu	250	41. Pupukea	727
19. Nuuanu Valley	50	42. Kahuku	25
20. Insane asylum	30	43. Ahuimanu	350
21. Moanalua	15	44. Heeia	100
22. Aiea (mauka)	500	45. Kaneohe	100
23. Aiea (makai)	100	46. Maunawili ranch	250
		47. Waimanalo	200

[1] Evaporation station.

Rainfall at Makapuu (station No. 1), Oahu, 1910–11.

[Elevation, 570 feet.]

Month	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January		1.69	September	2.39	1.11
February	0.41	5.35	October	.64	.30
March	.03	3.12	November	.26	1.20
April	.16	.48	December	1.66	.65
May	.13	.60			
June	.53	.06	Annual		15.54
July	.43	.28	Mean daily	[a] .022	.043
August	.79	.50			

[a] For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall on Mount Olympus (station No. 2), Manoa-Kailua divide, Oahu, 1910.

[Elevation, 2,450 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
1910.			
October 30[a]	36	5.6	0.16
November 30	31	7.8	.25
September 24 to November 30, 1910	67	13.4	.20

[a] Gage installed Sept. 24, 1910.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter. Gage destroyed about Jan. 1, 1911, by some person or persons unknown. No further records at this station.

Rainfall at Waiamao (station No. 3), Palolo Stream drainage basin, Oahu, 1910–11.

[Elevation, 600 feet.]

Month.	1910	1911	Month.	1910	1911
January		6.75	September		11.58
February		17.62	October	3.65	4.98
March		6.54	November	7.09	4.55
April		5.66	December	7.99	7.60
May		9.25			
June		6.03	Annual		93.59
July		4.87	Mean daily	[a].204	.256
August		8.16			

[a] For three months.

NOTE.—Standard U. S. Weather Bureau type of gage read daily until Oct. 9, 1911, afterward at irregular intervals.

Rainfall at Manoa (station No. 4), Manoa Stream drainage basin, Oahu, 1910–11.

[Elevation, 300 feet.]

Month.	1910	1911	Average 13 years.	Month.	1910	1911	Average 13 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	7.75	9.57	5.90	September	9.88	9.74	7.98
February	5.35	16.94	8.06	October	4.02	1.79	7.48
March	8.67	4.66	9.15	November	6.09	6.62	8.45
April	8.20	3.22	7.72	December	7.31	7.68	8.86
May	7.98	7.36	6.65				
June	10.73	5.92	5.49	Annual	89.24	86.34	90.50
July	5.01	5.35	6.79	Mean daily	.245	.236	.248
August	8.25	7.49	7.97				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Tantalus (Isenberg) (station No. 5), Manoa-Pauoa divide, Oahu, 1910–11.

[Elevation, 1,650 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	12.65	14.44	September	17.35	24.74
February	11.05	25.47	October	7.38	5.44
March	15.22	7.18	November	12.46	11.29
April	15.65	9.49	December	13.26	17.62
May	16.44	14.28			
June	16.52	17.70	Annual	162.12	171.50
July	11.08	10.95	Mean daily	.444	.470
August	13.06	12.90			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kaliula (station No. 6), Manoa-Pauoa divide, Oahu, 1910–11.

[Elevation, 1,200 feet.]

Month.	1910	1911	Average 10 years.	Month.	1910	1911	Average 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	8.90	9.83	7.12	September	10.38	14.18	8.62
February	3.28	20.03	9.28	October	4.61	3.87	6.71
March	8.80	4.41	9.81	November	8.44	6.16	8.04
April	7.47	4.65	6.79	December	7.11	12.43	9.84
May	8.39	6.77	6.31				
June	7.69	8.53	6.96	Annual	91.76	103.98	96.89
July	7.18	6.23	8.15	Mean daily	.251	.285	.265
August	9.51	6.89	9.26				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Rhodes' Gardens (station No. 7), Manoa Stream drainage basin, Oahu, 1910.

[Elevation, 300 feet.]

	Inches.		Inches.
January	12.21	September	20.53
February	8.94	October	8.44
March	11.47	November	11.42
April	18.58	December	13.26
May	18.90		
June	15.08	Annual	163.16
July	7.67	Mean daily	.447
August	16.66		

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at United States Experiment Station (station No. 8), Honolulu, Oahu, 1909–10.

[Elevation, 120 feet.]

Month.	1909	1910	Month.	1909	1910
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.61	6.60	September	2.62	.....
February	.....	2.71	October	1.80	.....
March	6.56	3.34	November	.98	.....
April	.....	2.76	December	9.08	.....
May	.....	.92			
June	2.73	.....	Annual	.....	[a] 39.72
July	4.28	.....	Mean daily	.....	[a] .109
August	1.90	.....			

[a] From June, 1909, to May, 1910.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Spencer Street (station No. 9), Honolulu, Oahu, 1910–11.

[Elevation, 100 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
June 30[a]	13	0.8	0.06	May 6	126	22.2	0.18
July 19	19	.8	.04	July 1	56	3.9	.07
Aug. 27	39	3.4	.09	Sept. 30	91	6.0	.07
Oct. 31	65	8.0	.12				
Dec. 31	61	6.6	.11	June 17, 1910, to Sept. 30, 1911[b]	470	51.7	.110

[a] Gage installed June 17, 1910.
[b] Standard U. S. Weather Bureau type of gage, at same location but read daily, for same period gave 49.87 inches, or 0.106 inches per day.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Kinau Street (station No. 10), Honolulu, Oahu, 1910–11.

[Elevation, 50 feet.]

Month.	1910	1911	Average, 28 years.	Month.	1910	1911	Average, 28 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.42	3.99	2.56	September	6.39	2.46	1.60
February	1.40	9.54	5.02	October	.84	1.42	1.79
March	1.61	3.35	3.27	November	3.30	71	3.63
April	2.84	1.44	1.89	December	2.66	2.61	4.51
May	1.41	3.09	1.72				
June	1.26	.41	.81	Annual	9.17	30.56	29.04
July	.83	.77	.96	Mean daily	.080	.084	.080
August	2.21	.77	1.28				

NOTE.—Compiled from United States Weather Bureau records.

Rainfall at United States Weather Bureau (station No. 11), Honolulu, Oahu, 1910–11.

[Elevation, 111 feet.]

Month.	1910	1911	Average, 23 years.	Month.	1910	1911	Average, 23 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.79	4.04	3.59	September	6.40	2.20	1.41
February	1.22	7.98	4.83	October	.63	.97	1.56
March	1.52	2.13	2.88	November	3.05	.47	3.91
April	1.48	1.70	2.23	December	2.64	2.94	3.54
May	1.86	2.62	2.08				
June	.76	.37	.88	Annual	27.34	26.71	29.68
July	.95	.67	1.34	Mean daily	.075	.073	.081
August	2.04	.62	1.43				

NOTE.—Compiled from United States Weather Bureau records.

74323°—WSP 318—13——28

Rainfall at United States Naval Station (station No. 12), Honolulu, Oahu, 1910–11.

[Elevation, 6 feet.]

Month.	1910	1911	Average, 11 years.	Month.	1910	1911	Average, 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.04	3.53	2.89	September	6.05	2.17	1.76
February	1.13	7.11	4.01	October	.50	1.03	1.29
March	.82	2.07	3.48	November	2.05	.40	2.99
April	1.41	.91	1.03	December	2.35	2.33	4.25
May	.52	2.02	.82				
June	.64	.48	.73	Annual	21.89	22.88	25.25
July	.60	.45	.85	Mean daily	.060	.063	.069
August	1.78	.38	1.15				

NOTE.—Compiled from United States Weather Bureau records.

Rainfall on Konahuanui Peak (station No. 13), Oahu, 1910–11.

[Elevation, 3,100 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Nov. 30 [a]	34	11.70	0.34	Aug. 1	45	7.20	0.16
1911.				Nov. 8	99	27.80	.28
Feb. 9	71	27.56	.39	Dec	46	10.40	.23
June 17	128	47.80	.37	Oct. 27, 1910, to Dec. 24, 1911	423	132.46	.31

[a] Gage installed Oct. 27, 1910.

NOTE.—Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter.

Rainfall at Nuuanu Pali (station No. 14), Nuuanu Stream drainage basin, Oahu, 1910–11.

[Elevation, 1,200 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Nov. 7 [a]	45	12.1	0.27	Oct. 5	31	13.4	0.43
1911.				Nov. 24	50	8.6	.17
Jan. 8	62	24.6	.40	1912.			
Feb. 24	47	26.4	.56	Jan. 4	41	10.2	.25
June 20	116	43.8	.38	Sept. 23, 1910, to Jan. 4, 1912	468	157.5	.34
Sept. 4	76	18.4	.24				

[a] Gage installed Sept. 23, 1910.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at upper Luakaha (station No. 15), Nuuanu Stream drainage basin, Oahu, 1910–11.

[Elevation, 1,125 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	10.53	25.51	September	16.84	25.28
February	11.49	23.80	October	9.60	5.49
March	13.51	8.74	November	19.25	11.72
April	12.39	17.75	December	20.20	14.37
May	22.25	28.00			
June	17.92	16.80	Annual	182.90	205.01
July	8.69	9.63	Mean daily	.501	.562
August	20.23	17.92			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at lower Luakaha (station No. 16), Nuuanu Stream drainage basin, Oahu, 1910–11.

[Elevation, 850 feet.]

Month.	1910	1911	Average 22 years.	Month.	1910	1911	Average 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	10.36	23.14	9.75	September	16.04	22.87	11.73
February	9.56	26.38	12.97	October	10.47	4.17	10.73
March	12.51	7.37	14.06	November	16.64	12.13	12.09
April	11.89	14.66	12.43	December	17.52	14.67	13.81
May	22.00	23.31	11.26				
June	17.36	13.91	9.81	Annual	172.03	186.45	141.07
July	9.15	8.38	9.95	Mean daily	.472	.511	.386
August	18.53	15.46	12.48				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at electric light power station (station No. 17), Nuuanu Stream drainage basin, Oahu, 1910–11.

[Elevation, 405 feet.]

Month.	1910	1911	Average 22 years.	Month.	1910	1911	Average 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	5.94	14.56	5.98	September	11.87	15.89	6.06
February	3.82	19.27	8.97	October	4.72	2.91	6.02
March	5.25	5.29	8.14	November	8.87	8.76	7.09
April	4.55	6.31	5.74	December	11.78	11.66	7.43
May	6.53	8.70	4.90				
June	5.71	7.67	4.98	Annual	81.17	112.29	75.65
July	5.21	3.94	4.83	Mean daily	.222	.308	.207
August	6.92	7.33	5.51				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Wyllie Street (station No. 18), Honolulu, Oahu, 1910–11.

[Elevation, 250 feet.]

Month.	1910	1911	Average 21 years.	Month.	1910	1911	Average 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	7.91	8.99	5.20	September	8.55	9.51	4.73
February	2.72	15.54	7.85	October	3.10	1.97	4.90
March	6.77	4.68	7.05	November	4.95	4.61	6.22
April	5.34	3.78	4.72	December	7.35	8.53	6.74
May	5.43	4.64	3.80				
June	.....	5.23	3.80	Annual	.....	74.34	64.02
July	.....	3.10	4.27	Mean daily	a.195	.204	.175
August	7.28	3.76	4.74				

a For 10 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Nuuanu Valley (station No. 19), Nuuanu Stream drainage basin, Oahu, 1910–11.

[Elevation, 50 feet.]

Month.	1910	1911	Average 38 years.	Month.	1910	1911	Average 38 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.60	6.02	3.88	September	8.21	4.64	2.37
February	1.79	11.24	5.42	October	1.28	1.62	2.56
March	3.62	3.42	4.05	November	3.63	1.90	4.91
April	2.68	2.49	2.91	December	3.85	5.60	4.88
May	.....	3.70	2.64				
June	2.63	1.93	1.83	Annual	.....	46.20	40.16
July	2.74	2.04	2.35	Mean daily	[a].122	.127	.110
August	3.61	1.60	2.36				

[a] For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at insane asylum (station No. 20), Honolulu, Oahu, 1910–11.

[Elevation, 30 feet.]

Month.	1910	1911	Average 20 years.	Month.	1910	1911	Average 20 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.82	6.01	3.61	September	7.22	4.06	2.32
February	1.63	10.47	6.03	October	1.05	1.03	2.56
March	2.53	3.75	4.64	November	3.13	1.79	4.14
April	2.46	2.18	2.51	December	4.34	5.25	4.76
May	2.52	3.15	1.88				
June	2.22	1.63	1.76	Annual	39.88	41.07	38.25
July	2.47	.69	1.91	Mean daily	.109	.112	.105
August	3.49	1.06	2.13				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Moanalua (station No. 21), Oahu, 1910–11.

[Elevation, 15 feet.]

Month.	1910	1911	Average 11 years.	Month.	1910	1911	Average 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.40	5.17	3.80	Sepetmber	5.08	2.92	1.98
February	1.53	8.72	5.14	October	.80	.72	1.51
March	1.04	2.05	4.32	November	3.20	1.01	3.48
April	1.61	1.10	1.33	December	3.55	3.70	5.38
May	.....	1.74	1.05				
June	2.30	.39	.98	Annual	.....	29.03	31.99
July	1.22	.85	1.43	Mean daily	[a].082	.080	.088
August	2.57	.66	1.59				

[a] For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Aiea (mauka) (station No. 22), Halawa Stream drainage basin, Oahu, 1910–11.

[Elevation, 500 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.93	4.10	September	5.55	3.69
February	1.70	11.62	October	1.24	1.26
March	3.11	3.24	November	3.69	2.18
April	4.46	1.76	December	4.29	3.78
May	2.46	2.28			
June	2.59	1.91	Annual	39.26	39.21
July	2.65	2.10	Mean daily	.108	.107
August	3.59	1.30			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Aiea (makai) (station No. 23), Oahu, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	3.71	3.61	.....	September	5.55	3.02	2.09
February	1.54	7.60	.....	October	1.12	1.22	1.37
March	1.96	2.82	.....	November	3.69	1.29	4.10
April	4.16	.94	1.77	December	3.88	3.29	5.30
May	1.54	1.43	1.17				
June	1.72	.70	1.22	Annual	33.91	27.99	.....
July	2.00	1.27	1.58	Mean daily	.093	.077	.....
August	3.04	.80	1.84				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Puuloa (station No. 24), Oahu, 1910–11.

[Elevation, 15 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	2.64	3.66	.....	September	5.46	1.70	1.40
February	.76	5.55	.....	October	.42	.49	.60
March	.51	2.83	.....	November	2.16	.03	2.63
April	.64	.91	0.58	December	3.57	1.43	3.80
May	.15	.85	.38				
June	.16	.04	.23	Annual	18.45	17.64	.....
July	.24	.04	.25	Mean daily	.051	.048	.....
August	1.74	.11	.85				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waimalu-uka (station No. 25), Waimalu Stream drainage basin, Oahu, 1910–11.

[Elevation, 500 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	5.18	3.74	September	10.00	3.77
February	2.40	11.34	October	1.45	1.74
March	4.46	1.85	November	2.93	2.09
April	5.22	1.65	December	4.58	5.01
May	3.14	.85			
June	3.22	1.05	Annual	48.97	36.36
July	2.54	1.88	Mean daily	.134	.100
August	3.85	1.39			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waimalu (station No. 26), Oahu, 1910–11.

[Elevation, 25 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	3.88	3.14	.....	September	8.35	2.18	2.56
February	1.66	7.72	.....	October	.92	1.73	1.42
March	2.23	2.21	.....	November	2.94	1.34	3.15
April	2.28	.76	1.55	December	3.40	3.29	5.43
May	1.35	.26	1.14				
June	1.73	.42	.93	Annual	32.63	24.60	.....
July	1.03	.86	1.05	Mean daily	.089	.067	.....
August	2.86	.69	1.58				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waiawa-Waiahole divide (station No. 27), Oahu, 1911.

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
1911.			
Jan. 5 [a]	31	12.2	0.40
Feb. 5	31	6.5	.21
Aug. 16 [b]	192	38.6	.20
Oct. 7	52	33.2	.64
Nov. 22	46	10.2	.22
1912.			
Jan. 3	42	17.0	.40
Dec. 5, 1910, to Jan. 3, 1912	394	117.7	.30

[a] Gage installed Dec. 5, 1910. [b] Gage moved to new location.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Waiawa (station No. 28), Waiawa Stream drainage basin, Oahu, 1910–11.

[Elevation, 675 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	5.30	4.49	September	9.89	4.36
February	1.96	10.88	October	3.24	1.77
March	4.59	3.24	November	3.70	2.60
April	3.68	2.40	December	4.95	4.97
May	3.73	1.76			
June	4.14	2.02	Annual	53.40	43.21
July	2.85	3.26	Mean daily	.146	.118
August	5.37	1.46			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Schofield Barracks (station No. 29), Oahu, 1910–11.

[Elevation, 990 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	2.30	4.96	September	9.87	2.61
February	3.25	5.86	October	.81	2.07
March	1.65	3.89	November	5.67	.84
April	1.22	1.17	December	2.49	2.26
May	3.18	2.93			
June	2.53	.72	Annual	38.19	28.16
July	1.27	.77	Mean daily	.107	.077
August	3.95	.08			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hoaeae (station No. 30), Waikakalaua Stream drainage basin, Oahu, 1910–11.

[Elevation, 725 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.06	3.53	September	8.59	2.39
February	1.06	7.75	October	.98	1.12
March	1.02	3.35	November	4.43	1.07
April	1.18	1.49	December	3.03	2.91
May	1.08	2.28			
June	1.62	.65	Annual	30.18	28.09
July	.77	.80	Mean daily	.083	.077
August	3.36	.75			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waipahu (station No. 31), Oahu, 1910–11.

[Elevation, 200 feet.]

Month.	1910	1911	Average 14 years.	Month.	1910	1911	Average 14 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	2.00	3.25	1.99	September	4.13	1.43	0.95
February	.54	7.08	4.74	October	.40	.81	1.39
March	.78	2.56	3.43	November	3.00	.67	2.25
April	.97	.75	.83	December	2.02	1.62	2.69
May	.16	1.52	1.00				
June	.44	.09	.46	Annual	16.65	20.43	20.80
July	.22	.27	.31	Mean daily	.046	.056	.057
August	1.99	.38	.76				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Ewa plantation (station No. 32), Oahu, 1910–11.

[Elevation, 50 feet.]

Month.	1910	1911	Average 21 years.	Month.	1910	1911	Average 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	1.18	3.11	2.14	September	3.28	1.07	1.03
February	.51	6.50	4.76	October	.35	.89	1.18
March	.39	1.44	2.60	November	3.21	.21	2.73
April	.41	.39	.80	December	3.24	1.42	3.17
May	.12	.43	.87				
June	.59	.32	.56	Annual	15.16	16.57	20.78
July	.63	.40	.38	Mean daily	.042	.045	.057
August	1.25	.39	.56				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Coast and Geodetic Survey magnetic station (station No. 33), Oahu, 1910–11.

[Elevation, 45 feet.]

Month.	1910	1911	Average 10 years.	Month.	1910	1911	Average 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	0.84	3.47	2.90	September	3.16	0.92	1.00
February	.45	7.37	4.83	October	.25	.63	.58
March	.21	1.46	3.41	November	2.66	.07	1.97
April	.51	.95	.49	December	4.53	.62	3.75
May	.03	.56	.72				
June	1.68	.11	.64	Annual	15.40	16.95	21.06
July	.11	.41	.21	Mean daily	.042	.046	.058
August	.97	.38	.56				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waianae mauka (station No. 34), Waianae Stream drainage basin, Oahu, 1910–11.

[Elevation, 1,600 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	7.23	5.45	September	10.32	4.91
February	8.09	6.71	October	2.44	3.64
March	1.81	6.01	November	6.95	2.66
April	6.11	3.74	December	5.69	3.88
May	4.69	2.50			
June	7.80	3.40	Annual	69.85	48.83
July	4.53	3.63	Mean daily	.191	.134
August	4.19	2.30			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waianae Mill (station No. 35), Oahu, 1910–11.

[Elevation, 6 feet.]

Month.	1910	1911	Average, 18 years.	Month.	1910	1911	Average, 18 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	0.46	3.30	2.88	September	4.41	0.51	0.97
February	1.87	2.25	5.30	October	.25	1.34	.98
March	.00	1.71	2.23	November	4.92	.00	2.65
April	.04	.21	.65	December	.63	.55	2.83
May	.44	1.59	.68				
June	1.03	.06	.28	Annual	15.01	12.04	20.77
July	.39	.29	.33	Mean daily	.041	.033	.056
August	.57	.23	.99				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kaala Gulch (station No. 36), Kaukonahua Stream drainage basin, Oahu, 1910–11.

[Elevation, 1,700 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	6.28	September	11.67	.....
February	.....	10.64	October	7.74	.....
March	.....	6.70	November	2.36	.....
April	.....	2.80	December	3.72	.....
May	.....	6.24			
June	.....	1.51	Annual	.....	.....
July	1.73	1.81	Mean daily	.....	[a] 0.170
August	4.13	.....			

[a] For 13 months, July, 1910, to July, 1911.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Wahiawa (station No. 37), Kaukonahua Stream drainage basin, Oahu, 1910.

[Elevation, 870 feet.]

Month.	1910	Average, 10 years.	Month.	1910	Average, 10 years.
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	2.94	4.86	September	9.05	3.42
February	2.48	8.27	October	1.16	2.87
March	4.06	6.72	November	5.76	.....
April	1.65	2.00	December	8.91	.....
May	2.19	2.98			
June	2.96	2.55	Annual	48.71	.....
July	1.67	2.33	Mean daily	.133	.....
August	5.88	3.80			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waialua Mill (station No. 38), Oahu, 1910–11.

[Elevation, 30 feet.]

Month.	1910	1911	Average, 11 years.	Month.	1910	1911	Average, 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	2.69	4.91	3.77	September	2.73	2.07	1.49
February	1.85	5.97	6.93	October	.55	.75	.96
March	1.57	4.18	4.12	November	5.80	.37	2.95
April	1.16	.17	1.05	December	3.53	3.59	4.67
May	.67	2.09	.90				
June	1.52	.24	.65	Annual	25.75	25.45	29.70
July	1.20	.52	1.04	Mean daily	.071	.070	.081
August	2.48	.59	1.17				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall, at Kawaiiki (station No. 39), Anahulu-Opaeula divide, Oahu, 1910–11.

[Elevation, 1,050 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	7.31	September	9.19	9.06
February	.....	17.95	October	5.64	3.58
March	.....	6.92	November	13.97	7.45
April	.....	7.79	December	13.60	7.84
May	.....	9.56			
June	6.05	7.30	Annual	.....	100.05
July	5.96	6.90	Mean daily	[a]30	.274
August	9.41	8.39			

[a] For 7 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waialua (Opaeula) (station No. 40), Anahulu-Opaeula divide, Oahu, 1910–11.

[Elevation, 1,100 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.51	5.39	September	5.80	4.26
February	5.13	10.63	October	2.11	1.82
March	5.36	4.41	November	7.53	2.61
April	5.56	2.28	December	6.25	4.42
May	3.90	5.45			
June	3.51	2.04	Annual	55.70	48.75
July	3.24	3.04	Mean daily	.153	.134
August	3.80	2.40			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Pupukea (station No. 41), Oahu, 1910–11.

[Elevation, 727 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	4.95	5.82	September	2.26	.....
February	1.80	9.08	October	2.00	.....
March	5.26	4.36	November	7.69	.....
April	3.74	2.11	December	6.47	5.55
May	5.23	3.66			
June	5.47	5.05	Annual	54.15	.....
July	4.37	.....	Mean daily	.148	[a].166
August	4.91	.....			

[a] For 6 months, January to June.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kahuku (station No. 42), Oahu, 1910–11.

[Elevation, 25 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.20	4.73	3.07	September	1.31	.61	2.30
February	1.72	5.43	5.92	October	2.28	.02	2.65
March	1.14	6.35	4.71	November	4.27	.96	3.86
April	1.53	.40	1.99	December	3.46	2.14	3.90
May	1.87	4.52	2.06				
June	1.97	1.23	1.33	Annual	28.13	36.60	35.79
July	1.44	1.49	1.61	Mean daily	.077	.100	.098
August	2.94	2.72	2.39				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Ahuimanu (station No. 43), Oahu, 1910–11.

[Elevation, 350 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	3.94	6.69	6.45	September	11.62	4.24	6.74
February	6.06	11.18	9.52	October	3.40	6.00	6.41
March	2.97	5.11	8.76	November	7.24	2.98	8.87
April	3.51	4.41	6.44	December	.....	5.24	9.44
May	2.96	11.73	6.94				
June	5.40	2.22	4.08	Annual	.....	62.92	83.97
July	3.41	2.20	4.38	Mean daily	*a*.174	.172	.230
August	7.66	.92	5.94				

a For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Heeia (station No. 44), Oahu, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.67	4.61	September	5.37	4.74
February	4.96	8.29	October	2.95	2.00
March	2.53	6.46	November	3.92	3.47
April	2.20	2.83	December	7.49	.....
May	1.54	10.65			
June	2.78	1.34	Annual	46.91	.....
July	1.90	.95	Mean daily	.129	*a*.147
August	7.60	3.92			

a For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kaneohe (station No. 45), Kaneohe Stream drainage basin, Oahu, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Average, 16 years.	Month.	1910	1911	Average, 16 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	5.22	5.24	3.76	September	5.68	4.35	3.90
February	3.59	10.24	5.85	October	3.02	4.03	4.30
March	1.90	6.02	6.70	November	4.58	2.53	4.96
April	2.37	1.23	3.84	December	7.90	4.42	6.80
May	2.18	9.21	4.26				
June	2.51	1.42	2.59	Annual	45.89	53.22	53.97
July	1.85	.85	2.57	Mean daily	.126	1.46	.148
August	5.09	3.68	4.44				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Maunawili ranch (station No. 46), Kailua Stream drainage basin, Oahu. 1910–11.

[Elevation, 250 feet.]

Month.	1910	1911	Average 17 years.	Month.	1910	1911	Average 17 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.58	7.23	5.65	September	10.22	6.37	5.58
February	5.98	17.91	8.92	October	4.45	4.48	5.44
March	4.62	7.95	8.73	November	5.80	3.66	6.82
April	4.20	3.11	6.15	December	10.79	7.50	9.83
May	6.51	11.64	6.37				
June	5.50	4.27	4.10	Annual	75.62	85.34	75.15
July	2.73	4.06	4.21	Mean daily	.207	.234	.214
August	10.24	7.16	6.25				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waimanalo (station No. 47), Oahu, 1910–11.

[Elevation, 200 feet.]

Month.	1910	1911	Average 18 years.	Month.	1910	1911	Average 18 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	2.90	3.59	4.21	September	7.34	2.32	2.08
February	2.27	13.84	7.11	October	2.83	1.81	2.50
March	1.45	5.05	6.39	November	2.46	.83	5.21
April	1.53	1.09	2.18	December	5.63	2.67	6.97
May	2.05	7.44	3.02				
June	2.01	.71	1.51	Annual	36.10	41.19	44.34
July	1.14	.65	1.40	Mean daily	.099	.113	.121
August	4.49	1.19	1.76				

NOTE.—Compiled from U. S. Weather Bureau records.

Alphabetic list of rainfall stations on Island of Oahu.

Name.	No.	Elevation.	Name.	No.	Elevation.
		Feet.			*Feet.*
Ahuimanu	43	350	Naval station (U. S.)	12	6
Aiea (mauka)	22	500	Nuuanu Pali	14	1,200
Aiea (makai)	23	100	Nuuanu Valley	19	50
Electric light power station	17	405	Pupukea	41	727
Ewa plantation	32	50	Puuloa	24	15
Experiment station (U. S.)	8	120	Rhodes' Gardens	7	300
Heeia	44	100	Schofield Barracks	29	990
Hoaeae [a]	30	725	Spencer Street Honolulu [a]	9	100
Insane asylum	20	30	Tantalus (Isenberg)	5	1,650
Kaala Gulch	36	1,700	Wahiawa	37	870
Kahuku	42	25	Waialua Mill	38	30
Kaliula	6	1,200	Waialua (Opaeula)	40	1,100
Kaneohe	45	100	Waiamao	3	600
Kawaiiki	39	1,050	Waianae (mauka)	34	1,600
Kinau Street, Honolulu	10	50	Waianae Mill	35	6
Konahuanui	13	3,100	Waiawa	28	675
Luakaha, lower	16	850	Waiawa-Waishole divide	27	.....
Luakaha, upper [a]	15	1,125	Waimalu	26	25
Magnetic station	33	45	Waimalu-uka	25	500
Makapuu	1	570	Waimanalo	47	200
Manoa	4	300	Waipahu	31	200
Maunawili ranch	46	250	Weather Bureau (U. S.)	11	111
Moanalua	21	15	Wyllie Street, Honolulu	18	250
Mount Olympus	2	2,450			

[a] Evaporation station.

RAINFALL RECORDS ON ISLANDS OF MAUI AND KAHOOLAWE.

Rainfall records were obtained at 49 stations on Maui during 1910 and 1911. Of these, 12 were on West Maui and 37 on East Maui, and they were fairly well distributed over the island, there being 25 stations above 1,000 feet, 9 above 2,000 feet, and 5 above 3,000 feet in elevation. Four stations were established on Kahoolawe late in 1911, one of these replacing a station where observations were made for several months during 1904–5.

The greatest amount of rainfall observed at any station was at Waikamoi mauka, on the windward slope of East Maui, where the total precipitation from the time the station was established, October 12, 1910, to December 31, 1911, was 455.78 inches, an average of slightly over 1 inch a day for the entire period. In comparison with this, the 13.01 inches of rainfall during 1911 and 11.28 inches during 1910 at the Hawaiian Commercial & Sugar Co.'s camp No. 7 (rainfall station No. 46) show the decidedly arid conditions prevailing on some parts of the island.

In the following tables credit is given to the United States Weather Bureau for the use of data and also to cooperating parties and observers for records furnished the Geological Survey. The location of the stations is shown on Plate XIV (at end of volume).

Rainfall stations on islands of Maui and Kahoolawe.

	Elevation (feet).
1. Waihee tunnels	1,550
2. Waihee	100
3. Waiehu	375
4. Iao Valley, cave	1,720
5. Iao Valley, tableland	1,500
6. Iao Valley, gaging station	830
7. Wailuku (Penhallow's residence)	390
8. Wailuku (mission)	250
9. Wailuku Mill	180
10. Kahului	8
11. Waikapu tunnel	1,535
12. Waikapu	600
13. Olowalu mauka	700
14. Olowalu	10
15. Puu Kukui	5,000
16. Kahoma reservoir	2,000
17. Puu Kukui slope	2,500
18. Honokawai Gulch	1,500
19. Honokawai powerhouse	1,200
20. Kaanapali	12
21. Mahana	1,800
22. Mokupea	1,000
23. Honokahua Gulch	760
24. Honolua	25
25. Honokahau ditch intake	806
26. Waihoi	2,200
27. Hana	145
28. Nahiku	700
29. Kopiliula	1,220
30. Keanae	1,000
31. Kupau camp	300
32. Honomanu	1,800
33. Waikamoi mauka	4,250
34. Waikamoi	1,250
35. Punaluu	710
36. Kailua	700
37. Lupi	1,160
38. Ukulele	5,300
39. Olinda	4,000
40. Haleakala Ranch	2,000
41. Makawao	1,700
42. Puuomalei	1,430
43. Haiku	700
44. Spreckelsville	50
45. Puunene	73
46. Camp No. 7 (Hawaiian Commercial & Sugar Co.)	90
47. Kihei	55
48. Kula (Erehwon)	4,200
49. Waiopae Ranch	1,740
50. Kahoolawe, Camp	80
51. Kahoolawe, Reservoir	500
52. Kahoolawe, Moaula	1,100
53. Kahoolawe, Kealia	600

Rainfall at Waihee water development tunnels (station No. 1), Waihee Stream drainage basin, Maui, 1910–11.

[Elevation, 1,550 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
1910.			
Dec. 12 [a]	28	51.6+	.....
1911.			
Mar. 3	81	51.6+	.....
Aug. 22	172	51.6+	.....
Nov. 29	99	51.6+	.....

[a] A special gage of 50-inch capacity, receiver 5.94 inches diameter, container 8.40 inches diameter, was installed Nov. 4, 1910. On Nov. 29, 1911, it was replaced by a gage of 300-inch capacity, the diameter of the receiver being 5.94 inches and that of the container 18.78 inches.

NOTE.—Every time the gage was visited it had overflowed. Under such conditions the actual capacity is 51.6 inches and not 50 inches. The rated capacity does include the capacity of the "neck" of the receiver, which is 1.6 inches. During the period covered by this record there was probably much more rainfall than the data show.

Rainfall at Waihee (station No. 2), Maui, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	8.95	4.35	September	0.56	4.55
February	1.97	6.99	October	1.22	1.40
March	1.06	3.74	November	.88	1.02
April	.90	2.29	December	12.74	1.80
May	.37	3.06			
June	1.60	.49	Annual	31.65	33.81
July	.28	2.84	Mean daily	.087	.093
August	1.12	1.28			

NOTE.—Gage read daily. Records furnished by H. B. Penhallow, manager Wailuku Sugar Co.

Rainfall at Waiehu (station No. 3), Maui, 1910–11.

[Elevation, 375 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	9.43	5.26	September	1.21	4.29
February	1.73	7.27	October	2.21	2.61
March	1.33	3.32	November	2.50	.95
April	.55	1.95	December	16.42	1.97
May	1.46	4.38			
June	.79	.71	Annual	41.27	35.62
July	1.11	1.65	Mean daily	.113	.098
August	2.53	1.26			

NOTE.—Gage read daily. Records furnished by Hawaiian Commercial & Sugar Co.

Rainfall at Iao Valley cave (station No. 4), Iao Stream drainage basin, Maui, 1910–11.

[Elevation, 1,720 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Dec. 9 [a]	35	25.4	0.73	June 24	56	36.4	0.65
1911.				Sept. 1	69	21.4	.31
Jan. 15	36	13.6	.38	Oct. 10	39	23.2	.60
Feb. 19	35	31.0	.89	Dec. 2	53	8.6	.16
Mar. 26	35	13.6	.39	Nov. 5, 1910, to Dec. 2, 1911	392	188.0	.48
Apr. 29	34	14.8	.44				

[a] Gage installed Nov. 5, 1910.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Iao Valley tableland (station No. 5), Iao Stream drainage basin, Maui, 1910–11.

[Elevation, 1,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
July 10–31 [a]	21	9.94	0.47	Apr. 29 [b]	17	10.4	0.61
August	31	18.49	.60	June 24	56	32.6	.58
September	30	1.73	.058	Sept. 1	69	13.6	.20
October	31	7.18	.23	Oct. 10	39	26.2	.67
November [a]	30	9.34	.31	Dec. 2	53	8.4	.16
December							
July 10 to Dec. 30	143	46.68	.33	Apr. 12 to Dec. 2	234	91.2	.39

[a] This was an English type of gage loaned to the County of Maui in May, 1910. No records available before July 10 nor after Nov. 30, 1910. Readings made at irregular intervals, and these figures may not include all the rainfall during the period indicated.

[b] Special gage, 50-inch capacity, receiver 5.94 inches diameter, container 8.40 inches diameter, installed at same location Apr. 12, 1911.

Rainfall at Iao gaging station (station No. 6), Iao Stream drainage basin, Maui, 1910–11.

[Elevation, 830 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
Nov. 2–30 [a]	28	5.41	0.19	Apr. 12–29 [c]	17	3.2	0.18
December	31	21.87	.71	June 24	56	17.2	.31
1911.				Sept. 1	69	9.6	.14
January	31	10.96	.35	Oct. 10	39	12.8	.33
February	28	10.68	.38	Dec. 2	53	3.4	.06
March	31	4.63	.15				
Apr. 1–8 [b]	8	.78	.10	Nov. 2, 1910, to Dec. 2, 1911 [d]	391	100.53	.26

[a] Gage installed Nov. 2, 1910. This was an English type of gage and readings were made at irregular intervals.

[b] Gage removed by some person or persons unknown soon after Apr. 8, 1911.

[c] Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter, installed Apr. 12, 1911.

[d] No record for period Apr. 8–12, 1911.

Rainfall at H. B. Penhallow's residence (station No. 7), Wailuku, Maui, 1896–1911.

[Elevation, 390 feet.]

Month.	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	2.86	1.20	0.00	2.09	2.22	1.58	8.15	4.40	3.38
February	.....	.00	3.90	1.98	5.96	17.97	2.00	5.20	16.95	1.23
March	.....	.00	2.66	10.23	.70	3.53	9.49	.95	6.15	4.72
April	.....	.00	.00	.00	1.45	1.15	10.82	3.11	.00	2.73
May	.....	.71	.50	.42	.00	.00	2.81	2.13	.00	1.25
June	.....	.00	.00	.00	.29	.00	1.82	.00	.59	.00
July	.....	.00	.00	.00	.50	.14	.25	1.35	.00	.00
August	.....	.59	.00	.24	.00	.05	.32	.00	.00	.00
September	.....	.22	1.02	.00	.00	.10	.77	1.25	1.13	1.69
October	.....	.00	.00	1.83	10.99	.42	.75	5.21	.92	.00
November	1.45	5.04	.57	.43	4.20	3.88	2.66	2.08	5.44	1.15
December	7.00	1.87	4.86	.46	2.25	3.64	8.41	1.59	6.78	2.55
Annual	.....	11.29	14.71	15.59	38.43	33.10	41.68	31.02	42.36	18.70
Mean daily	[a].14	.031	.040	.043	.105	.091	.114	.085	.116	.051

Month.	1906	1907	1908	1909	1910	1911	Average, 15 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	5.75	13.48	1.16	0.52	2.38	6.58	3.72	13.48	0.00
February	.00	8.78	.67	1.83	1.30	6.39	4.94	17.97	.00
March	5.53	1.81	3.03	8.00	.62	3.51	4.06	10.23	.00
April	2.35	1.40	.38	3.00	1.24	1.25	1.92	10.82	.00
May	.37	.00	.06	1.40	1.47	3.51	.98	3.51	.00
June	.00	.00	.00	.10	.85	.67	.29	1.82	.00
July	.00	.52	.00	.33	.30	.98	.29	1.35	.00
August	1.21	2.65	.00	.11	1.24	.76	.48	2.65	.00
September	.40	.00	.40	.31	.26	1.50	.60	1.69	.00
October	2.25	1.21	.00	2.84	.93	.25	2.50	20.99	.00
November	2.50	.54	1.88	.05	1.97	.22	2.13	5.44	.05
December	9.13	.80	1.31	4.21	16.98	1.16	4.56	16.98	.46
Annual	29.49	31.19	8.89	22.70	29.54	26.78	26.36	42.36	8.89
Mean daily	.081	.085	.024	.062	.081	.073	.072	.116	.024

[a] For 2 months.

NOTE.—Gage read daily. Records furnished by H. B. Penhallow, manager Wailuku Sugar Co.

Rainfall at Wailuku mission (station No. 8), Maui, 1910–11.

[Elevation, 250 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	9.35	4.67	5.13	September	0.28	2.20	1.03
February	1.34	5.26	4.96	October	.62	.38	1.16
March	1.19	3.40	4.74	November	1.25	.53	2.14
April	1.03	1.08	2.34	December	16.01	1.35	5.21
May	1.28	3.09	.98				
June	.84	.43	.50	Annual	34.95	23.92	30.05
July	.20	.84	.66	Mean daily	.096	.066	.082
August	1.56	.69	1.20				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Wailuku mill (station No. 9), Maui, 1910–11.

[Elevation, 180 feet.]

Month.	1910	1911	Average, 25 years.	Month.	1910	1911	Average, 25 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	9.40	4.41	3.72	September	0.29	2.11	0.72
February	1.26	6.17	5.19	October	1.17	.25	1.38
March	.68	3.37	3.75	November	1.33	.57	2.91
April	1.03	1.01	1.77	December	15.65	1.71	3.80
May	1.07	3.19	.93				
June	.93	.28	.33	Annual	34.50	24.43	25.94
July	.21	.73	.52	Mean daily	.095	.067	.071
August	1.48	.63	.92				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kahului (station No. 10), Maui, 1910–11.

[Elevation, 8 feet.]

Month.	1910	1911	Average, 13 years.	Month.	1910	1911	Average, 13 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.18	2.63	2.27	September	0.12	1.77	0.33
February	.15	4.57	2.27	October	.93	.33	.90
March	1.10	2.64	1.48	November	.68	.43	1.67
April	.81	.58	.65	December	8.68	.98	3.18
May	.65	1.84	.57				
June	.93	.25	.15	Annual	21.49	16.92	14.30
July	.17	.41	.41	Mean daily	.059	.046	.039
August	1.09	.49	.42				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waikapu water development tunnel (station No. 11), Waikapu Stream drainage basin, Maui, 1910–11.

[Elevation, 1,535 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
1910.			
Dec. 10[a]	37	28.6	0.77
1911.			
Jan. 6	27	10.6	.39
Feb. 16	41	24.6	.60
Nov. 3, 1910, to Feb. 16, 1911	105	63.8	.60

[a] Gage installed Nov. 3, 1910. About May 1, 1911, gage was removed by unknown parties and was not replaced until Dec. 1. No records available after Feb. 16, 1911.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Waikapu (station No. 12), Maui, 1895–1906.

[Elevation, 600 feet.]

Month.	1895	1896	1897	1898	1899	1900	1901	1902
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	2.85	2.20	0.00	0.00	0.51	0.00	0.58
February	.....	.00	.00	3.75	1.58	3.80	18.75	2.37
March	.....	2.77	.00	1.49	11.08	.76	1.15	5.26
April	.....	.50	.00	.33	.71	1.38	.50	.75
May	1.30	.00	.80	.28	.32	.35	.00	2.08
June	.15	.00	.00	.19	.00	.00	.00	2.86
July	.33	.56	.00	.00	.17	.00	.00	.00
August	2.26	.00	.00	.24	.22	.00	.00	.00
September	1.85	.00	.40	.13	.00	.00	.00	.67
October	.85	1.00	.00	.00	.87	2.50	.00	.75
November	3.30	1.30	2.80	.25	1.12	5.80	4.50	2.21
December	2.03	6.60	1.80	3.28	.21	.00	.50	7.25
Annual	.....	15.58	8.00	9.94	16.28	15.10	25.40	24.78
Mean daily	[a].049	.043	.022	.027	.045	.041	.070	.068

Month.	1903	1904	1905	1906	Average, 11 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	5.52	3.80	2.49	5.75	2.15	5.75	0.00
February	3.63	18.08	1.25	.00	4.84	18.75	.00
March	1.37	9.50	3.15	2.78	3.57	11.08	.00
April	3.70	1.06	3.53	2.09	1.32	3.70	.00
May	.00	.00	.00	.....	.47	2.08	.00
June	1.30	.31	.00	.....	.44	2.86	.00
July	1.10	.00	.50	.....	.24	1.10	.00
August	.28	.00	.80	.....	.35	2.26	.00
September	.00	1.34	2.10	.....	.59	2.10	.00
October	4.42	.70	.00	.....	1.01	4.42	.00
November	2.35	2.44	.90	.....	2.45	5.80	.25
December	1.55	1.92	1.42	.....	2.41	7.25	.00
Annual	25.22	39.15	16.14	.....	19.84	39.15	8.00
Mean daily	.069	.107	.044	[b].088	.054	.107	.022

[a] For 8 months. [b] For 4 months.

NOTE.—Gage read daily. Records furnished by H. B. Penhallow, manager Wailuku Sugar Co.

Rainfall at Olowalu mauka (station No. 13), Olowalu Stream drainage basin, Maui, 1911.

[Elevation, 700 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Nov. 1[a] to Dec. 31	60	10.8	0.18

[a] Gage installed Nov. 1, 1911.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Olowalu (station No. 14), Maui, 1907–1911.

[Elevation, 10 feet.]

Month.	1907	1908	1909	1910	1911	Average, 5 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	18.23	0.18	0.75	13.10	7.24	7.90	18.23	0.18
February	11.55	.00	4.77	.00	9.64	5.19	11.55	.00
March	5.40	4.30	6.35	.75	10.75	5.51	10.75	.00
April	.00	.00	1.43	.00	.30	.35	1.43	.00
May	.58	.00	.00	.00	1.10	.34	1.10	.00
June	.00	.00	.00	.18	.00	.04	.18	.00
July	.00	.00	.00	.00	.00	.00	.00	.00
August	5.56	.00	.00	.42	.00	1.20	5.56	.00
September	4.75	.40	.00	1.07	.70	1.38	4.75	.00
October	.00	.00	5.45	.00	.00	1.09	5.45	.00
November	.00	1.44	.00	.00	.00	.29	1.44	.00
December	2.20	.45	8.55	9.03	.00	4.05	9.03	.00
Annual	48.27	6.77	27.30	24.55	29.73	27.32	48.27	6.77
Mean daily	.132	.018	.075	.067	.081	.075	.132	.018

NOTE.—Gage read daily. Records furnished by Geo. Gibb, manager Olowalu Sugar Co.

Rainfall on Puu Kukui Mountain (station No. 15), Honokawai Stream drainage basin, Maui, 1911.

[Elevation, 5,000 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Nov. 30 [a]	48	23.5	0.49
Dec. 31	31	22.0	.71
Oct. 13 to Dec. 31	79	45.5	.58

[a] Gage installed Oct. 13, 1911.

NOTE.—Special gage, 125-inch capacity; receiver 5.94 inches diameter; container 13.3 inches diameter.

Rainfall at Kohoma reservoir (station No. 16), Maui, 1910–11.

[Elevation, 2,000 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	6.39	September	3.23	5.89
February	.....	16.68	October	1.30	.71
March	.....	3.36	November	[a] .62	3.45
April	4.10	1.51	December	10.38	4.19
May	4.25	2.54			
June	2.96	.28	Annual	.....	48.61
July	2.50	1.35	Mean daily	[b] .128	.133
August	4.23	2.26			

[a] For Nov. 15–30. [b] For 261 days.

NOTE.—Gage read daily. Records furnished by E. Brecht.

Rainfall on Puu Kukui slope (station No. 17), Honokawai Stream drainage basin, Maui, 1911.

[Elevation, 2,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Nov. 30 [a]	48	6.5	0.14
Dec. 31	31	8.0	.26
Oct. 13 to Dec. 31	79	14.5	.18

[a] Gage installed Oct. 13, 1911.

NOTE.—Special gage, 125-inch capacity; receiver 5.94 inches diameter; container 13.3 inches diameter.

Rainfall in Honokawai Gulch (station No. 18), Honokawai Stream drainage basin, Maui, 1911.

[Elevation, 1,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Nov. 30 [a]	44	8.6	0.20
Dec. 31	31	9.6	.31
Oct. 17 to Dec. 31	75	18.2	.24

[a] Gage installed Oct. 17, 1911.

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter.

Rainfall at Honokawai power house (station No. 19), Maui, 1910–11.

[Elevation, 1,200 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.12	5.52	September	0.98	3.82
February		12.83	October	2.81	1.39
March		3.26	November	3.49	2.58
April	3.12	3.32	December	6.45	4.40
May	3.98	3.35			
June	2.21	2.98	Annual	31.51	46.43
July	2.33	1.15	Mean daily	[a] 103	.127
August	3.02	1.83			

[a] For 11 months.

NOTE.—Gage read daily. Records furnished by E. Brecht.

Rainfall at Kaanapali (station No. 20), Maui, 1910–11.

[Elevation, 12 feet.]

Month.	1910	1911	Average, 13 years.	Month.	1910	1911	Average, 13 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	.....	5.22	4.06	September	0.15	0.90	0.61
February	1.61	6.17	3.82	October	.80	.14	.86
March	.55	2.55	1.91	November	.45	.18	1.63
April	1.51	.92	1.01	December	4.01	1.17	3.59
May	.89	.67	.60				
June	1.25	.11	.48	Annual	.....	18.11	20.81
July	.25	(a)	.63	Mean daily	b.035	.050	.057
August	.31	.08	1.61				

a Trace of rain, but too small to measure. b For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Mahana (station No. 21), Honokahua Stream drainage basin, Maui, 1910–11.

[Elevation, 1,800 feet.]

Month.	1910	1911	Average, 15 years.	Month.	1910	1911	Average, 15 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	13.50	12.56	9.54	September	3.97	19.23	7.15
February	7.62	17.57	11.69	October	5.77	3.65	7.90
March	8.86	2.96	10.61	November	9.89	7.86	9.48
April	7.25	8.24	9.32	December	19.94	8.18	11.95
May	11.20	8.88	7.86				
June	8.49	13.83	6.30	Annual	115.92	119.40	110.24
July	7.08	4.34	7.98	Mean daily	.318	.327	.302
August	12.35	12.10	10.46				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Mokupea (station No. 22), Honokahua Stream drainage basin, Maui, 1910–11.

[Elevation, 1,000 feet.]

Month.	1910	1911	Average 13 years.	Month.	1910	1911	Average 13 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	12.21	9.67	8.49	September	2.30	14.72	6.41
February	8.73	12.98	11.39	October	4.49	2.63	7.24
March	7.07	2.72	8.27	November	5.14	5.54	8.38
April	5.84	5.43	8.01	December	18.36	6.63	9.88
May	7.52	6.86	6.68				
June	6.30	8.13	5.64	Annual	91.74	85.48	95.41
July	5.39	3.02	6.66	Mean daily	.251	.234	.261
August	8.39	7.15	8.36				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Honokahua Gulch (station No. 23), Maui, 1907–1911.

[Elevation, 760 feet.]

Month.	1907	1908	1909	1910	1911	Average, 5 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	2.58	1.67	10.34	8.48	5.77	10.34	1.67
February	6.70	8.77	4.86	6.09	10.51	7.38	10.51	4.86
March	4.02	6.45	11.77	5.25	2.89	6.07	11.77	2.89
April	3.16	3.02	4.87	4.51	4.86	4.08	4.87	3.02
May	2.41	3.09	5.22	7.18	3.56	4.29	7.18	2.41
June	4.96	4.65	4.13	5.32	5.74	4.96	5.74	4.13
July	4.13	4.00	7.76	5.20	3.51	4.92	7.76	3.51
August	9.13	6.94	2.84	8.98	4.88	6.55	9.13	2.84
September	4.31	5.42	2.89	1.06	7.49	4.23	7.49	1.06
October	4.56	2.03	4.63	3.77	2.57	3.51	4.63	2.03
November	5.48	3.38	2.22	5.02	3.89	4.00	5.48	2.22
December	1.98	4.55	9.51	13.59	4.58	6.84	13.59	1.98
Annual	.....	54.88	62.37	76.31	62.96	62.40	76.31	54.88
Mean daily	[a].152	.150	.171	.209	.172	.171	.209	.150

[a] For 11 months.

NOTE.—Gage read daily. Records furnished by David Fleming, manager Honolua ranch.

Rainfall at Honolua (station No. 24), Maui, 1910–11.

[Elevation, 25 feet.]

Month.	1910	1911	Average 19 years.	Month.	1910	1911	Average 19 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	7.96	5.96	4.19	September	1.30	7.77	2.57
February	3.28	7.08	5.50	October	2.42	1.34	2.67
March	3.08	2.47	4.17	November	2.66	3.12	3.80
April	2.72	2.39	2.66	December	8.16	3.04	4.79
May	2.98	2.94	1.71				
June	2.49	2.37	1.82	Annual	45.12	46.66	39.21
July	2.20	2.77	2.37	Mean daily	.124	.128	.107
August	5.87	5.41	2.96				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Honokahau ditch intake (station No. 25), Maui, 1907–1911.

[Elevation, 806 feet.]

Month.	1907	1908	1909	1910	1911	Average, 5 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	5.39	3.37	18.57	16.65	10.98	18.57	3.37
February	20.61	12.20	8.18	10.16	20.01	14.23	20.61	8.18
March	8.66	9.25	30.10	11.99	6.81	13.36	30.10	6.81
April	14.08	7.48	16.03	9.16	12.42	11.83	16.03	7.48
May	5.46	6.48	13.96	9.78	15.13	10.16	15.13	5.46
June	5.70	5.51	10.65	14.43	15.23	10.31	15.23	5.51
July	9.45	9.56	14.90	10.26	9.72	10.78	14.90	9.45
August	25.15	13.14	4.65	23.93	19.10	17.20	25.15	4.65
September	13.04	9.63	5.91	5.64	25.31	11.90	25.31	5.64
October	16.36	5.34	9.13	6.69	10.08	9.52	16.36	5.34
November	10.24	8.53	6.71	14.25	11.72	10.30	14.25	6.71
December	2.67	12.56	13.63	29.59	9.39	13.57	29.59	2.67
Annual	.....	105.07	137.22	164.45	171.57	144.34	171.57	105.07
Mean daily	[a].39	.29	.38	.45	.47	.40	.47	.29

[a] For 11 months.

NOTE.—Gage read daily. Records furnished by David Fleming, manager Honolua ranch.

Rainfall at Waihoi (station No. 26), near Hana, Maui, 1910–11.

[Elevation, 2,200 feet.]

Date of observation.	Recorded rainfall.	Date of observation.	Recorded rainfall.
1910.	*Inches.*	1911.	*Inches.*
July 24	4.30	Feb. 2	9.86
31	4.70	9	9.80
Aug. 7	8.50	16	9.68
14	9.20	23	8.66
21	8.30	Mar. 2	9.42
28	10.40	9	7.26
Sept. 4	9.10	16	8.86
11	4.20	23	8.94
15	2.58	30	7.68
18	5.58	Apr. 13	8.64
25	3.68	27	9.84
Oct. 2	7.90	May 4	8.76
10	6.30	11	9.60
17	7.86	18	8.94
24	5.30	Aug. 28	3.06
31	7.56	Sept. 19	8.64
Nov. 7	6.88	25	9.88
14	7.66	30	9.72
21	8.42	Oct. 6	8.62
28	8.67	12	7.94
Dec. 5	8.87	18	.48
12	9.98	24	.29
19	9.86	30	1.91
29	8.32	Nov. 6	1.48
1911.		12	1.22
Jan. 5	9.94	19	2.46
9	8.86	24	2.38
12	9.82	30	2.54
16	8.62	Dec. 5	2.06
19	8.74	11	2.28
23	8.60	16	2.04
26	9.34	24	2.26
		30	2.84

NOTE.—Record furnished by county of Maui and published as received. Readings were discontinued during the period from May 18 to Aug. 28, 1911. It is not known positively whether these data represent all the readings made by the observer.

Rainfall at Hana (station No. 27), Maui, 1910–11.

[Elevation, 145 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	13.21	9.84	September	3.89	10.56
February	4.39	9.66	October	3.80	3.02
March	4.78	6.05	November	3.21	3.12
April	4.39	5.50	December	31.82	4.05
May	4.60	6.50			
June	5.14	4.18	Annual	96.94	71.02
July	3.36	2.58	Mean daily	.265	.195
August	14.35	5.96			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Nahiku (station No. 28), Maui, 1910–11.

[Elevation, 700 feet.]

Month.	1910	1911	Average, 11 years.	Month.	1910	1911	Average, 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	20.23	16.44	14.46	September	7.14	30.50	13.39
February	9.79	18.16	13.28	October	8.37	12.25	12.31
March	9.18	6.59	19.54	November	10.48	11.58	16.93
April	11.30	10.04	18.11	December	43.35	8.89	17.38
May	11.53	19.49	10.81				
June	12.92	12.87	10.59	Annual	175.05	174.55	178.31
July	9.70	8.51	13.18	Mean daily	.480	.478	.488
August	21.06	19.23	18.33				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kopiliula (station No. 29), Koolau ditch region, Maui, 1910–11.

[Elevation, 1,220 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	33.08	27.73	September	10.69	39.70
February	14.03	26.73	October	11.61	10.85
March	17.94	4.35	November	16.98	20.11
April	16.38	19.13	December	53.68	14.08
May	20.80	22.52			
June	23.51	22.06	Annual	263.40	245.61
July	17.16	14.08	Mean daily	.722	.673
August	27.54	24.27			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Keanae (station No. 30), Koolau ditch region, Maui, 1910–11.

[Elevation, 1,000 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	29.03	27.40	September	13.05	43.91
February	17.36	37.84	October	13.48	9.77
March	22.53	4.67	November	20.30	22.55
April	18.37	21.45	December	59.59	15.98
May	22.33	24.53			
June	29.28	26.75	Annual	297.12	274.74
July	21.64	15.31	Mean daily	.814	.752
August	30.17	24.94			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kupau camp (station No. 31), near Keanae, Maui, 1911.

[Elevation, 300 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Aug. 31 [a]	30	29.30	0.98
Sept. 30	30	30.42	1.01
Oct. 31	31	22.70	.73
Aug. 1 to Oct. 31	91	82.42	.91

[a] Gage installed Aug. 1, 1911.

NOTE.—Gage of U. S. Weather Bureau type was read daily.

Rainfall at Honomanu (station No. 32), Spreckels ditch region, Maui, 1910–11.

[Elevation, 1,800 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	27.82	26.73	September	13.61	41.86
February	21.27	39.35	October	13.37	9.55
March	24.08	7.08	November	20.44	21.85
April	18.66	25.94	December	60.50	15.66
May	22.29	28.63			
June	29.01	28.47	Annual	300.91	285.11
July	21.85	15.67	Mean daily	.822	.781
August	28.01	24.32			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waikamoi mauka (station No. 33), Maui, 1910–11.

[Elevation, 4,250 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January		43.92	September		34.70
February		76.15	October	6.40	13.69
March		7.98	November	20.10	28.60
April		27.80	December	80.02	26.48
May		33.23			
June		23.69	Annual		349.26
July		10.72	Mean daily	[a] 1.33	.96
August		22.30			

[a] For 80 days.

NOTE.—Gage, of U. S. Weather Bureau type, installed Oct. 12, 1910.

Rainfall at Waikamoi (station No. 34), Spreckels ditch region, Maui, 1910–11.

[Elevation, 1,250 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	22.30	24.97	September	9.10	41.48
February	13.22	30.70	October	10.84	11.20
March	18.63	6.69	November	16.94	18.01
April	13.87	16.90	December	49.66	14.58
May	18.79	23.01			
June	24.86	22.48	Annual	239.97	245.64
July	16.33	12.74	Mean daily	.658	.673
August	25.43	22.88			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Punaluu (station No. 35), Center ditch region, Maui, 1910–11.

[Elevation, 710 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	17.02	15.51	September	4.77	31.07
February	7.32	13.24	October	7.22	8.00
March	10.86	4.50	November	8.45	10.71
April	7.57	9.77	December	27.88	.....
May	8.90	.....			
June	11.06	12.46	Annual	138.73	.....
July	9.10	6.36	Mean daily	.380	[a] .423
August	18.58	16.52			

[a] For 10 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kailua (station No. 36), Spreckels ditch region, Maui, 1910–11.

[Elevation, 700 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	17.57	16.97	September	6.56	25.27
February	8.31	17.99	October	7.22	8.36
March	12.18	6.44	November	9.96	11.11
April	6.98	11.14	December	31.17	10.81
May	10.74	14.14			
June	11.90	13.48	Annual	149.99	156.69
July	8.09	6.57	Mean daily	.411	.429
August	19.31	14.41			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Lupi (station No. 87), Maui, 1897–1911.

[Elevation, 1,160 feet.]

Month.	1897	1898	1899	1900	1901	1902	1903	1904	1905
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	6.03	21.05	(a)	7.14	10.58	6.40	17.41	21.90	8.22
February	8.26	8.54	(a)	9.66	13.63	6.10	10.13	12.98	4.03
March	6.18	26.06	(a)	5.74	12.94	52.72	8.21	9.31	14.33
April	5.47	5.92	9.26	17.36	6.44	18.94	22.76	27.08	14.94
May	3.54	12.69	13.67	15.48	1.28	22.58	4.78	5.02	17.46
June	3.76	5.77	10.47	5.87	6.00	4.23	9.07	6.22	10.32
July	10.44	8.51	6.69	15.03	6.57	8.57	24.71	11.02	9.65
August	13.03	8.89	10.03	12.33	4.10	15.53	13.24	12.23	23.15
September	5.58	9.72	3.55	5.87	5.65	10.23	16.65	5.03	25.77
October	7.47	9.29	16.55	14.90	8.76	15.07	13.34	8.37	14.72
November	11.18	8.71	7.61	12.57	20.30	17.65	15.92	10.07	15.88
December	13.53	15.54	2.68	6.77	10.69	24.23	13.26	9.60	11.43
Annual	94.47	140.69	.....	128.72	106.94	202.25	169.48	138.83	167.90
Mean daily	.26	.39	b .29	.35	.29	.55	.46	.38	.46

Month.	1906	1907	1908	1909	1910	1911	Average, 14 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	10.30	5.09	5.78	5.22	19.30	18.70	11.65	21.90	5.09
February	3.56	13.82	17.08	11.27	8.22	27.38	11.05	27.38	3.56
March	12.48	13.56	4.76	33.20	14.51	9.42	15.96	52.72	4.76
April	13.26	14.35	13.30	13.53	10.29	11.93	13.66	27.08	5.47
May	9.44	3.62	8.17	14.16	13.20	12.36	10.49	22.58	1.28
June	6.65	10.70	9.99	12.14	18.20	18.70	9.21	18.70	3.76
July	10.47	13.40	13.36	21.32	12.40	8.55	12.05	24.71	6.57
August	22.08	32.54	16.98	6.56	21.45	16.51	15.24	32.54	4.10
September	10.89	14.97	13.46	10.99	7.83	28.70	11.53	28.70	3.55
October	10.64	13.59	8.31	9.53	7.81	7.40	11.06	16.55	7.40
November	12.13	15.96	9.26	8.07	13.84	15.35	12.97	20.30	7.61
December	26.21	4.26	16.55	15.43	33.14	13.94	14.49	33.14	2.68
Annual	148.11	155.86	137.00	161.42	180.19	188.94	151.49	202.25	94.47
Mean daily	.41	.43	.37	.44	.49	.52	.415	.55	.26

a Record missing. b For 9 months.

NOTE.—Gage read daily. Records furnished by S. E. Hubbard.

Rainfall at Ukulele (station No. 38), Maui, 1910–11.

[Elevation, 5,300 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	17.96	7.90	September	3.92	12.05
February	7.80	31.40	October	5.78	.95
March	9.22	6.81	November	4.30	7.45
April	11.90	9.65	December	18.72	11.00
May	8.75	10.10			
June	5.20	2.70	Annual	104.70	106.21
July	3.35	1.15	Mean daily	.287	.291
August	7.80	5.05			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Olinda (station No. 39), Maui, 1910–11.

[Elevation, 4,000 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January		8.76	September	1.67	6.77
February		21.36	October	2.21	(*a*)
March		10.32	November	3.52	4.52
April		5.71	December	14.71	7.66
May		6.82			
June		1.63	Annual		
July		(*a*)	Mean daily	*b*.23	*c*.24
August		3.09			

a Record missing. *b* For 96 days. *c* For 10 months.

NOTE.—Gage, of U. S. Weather Bureau type, was installed Sept. 26, 1910.

Rainfall at Haleakala ranch (station No. 40), Maui, 1910–11.

[Elevation, 2,000 feet.]

Month.	1910	1911	Average, 20 years.	Month.	1910	1911	Average, 20 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	10.18	5.49	6.32	September	2.02	2.72	2.23
February	3.22	10.69	6.84	October	.66	.14	2.24
March	1.50	5.21	7.45	November	2.17	.85	4.82
April	6.27	1.98	3.29	December	9.75	3.60	7.18
May	3.93	2.03	1.65				
June	2.28	.37	.96	Annual	46.55	33.58	47.01
July	2.07	.00	1.27	Mean daily	.128	.092	.129
August	2.50	.50	2.76				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Makawao (station No. 41), Maui, 1910–11.

[Elevation, 1,700 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	32.02	5.34	September	2.56	4.42
February	10.33	15.09	October	2.93	.53
March	6.12	5.02	November	4.22	3.50
April	6.93	3.48	December	10.61	4.85
May	4.75	4.14			
June	3.57	1.65	Annual	91.24	49.79
July	3.66	.22	Mean daily	.250	.136
August	3.54	1.55			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Puuomalei (station No. 42), Maui, 1910–11.

[Elevation, 1,430 feet.]

Month.	1910	1911	Average, 17 years.	Month.	1910	1911	Average, 17 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	13.71	7.14	6.75	September	4.04	11.38	4.55
February	5.71	18.42	7.34	October	5.36	2.67	5.00
March	8.28	4.00	10.46	November	5.43	5.83	7.09
April	9.21	6.39	6.82	December	16.53	7.01	9.38
May	6.79	5.00	4.21				
June	5.88	5.62	3.04	Annual	92.12	79.60	73.73
July	5.28	2.12	3.78	Mean daily	.252	.218	.202
August	5.90	4.02	5.31				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Haiku (station No. 43), Maui, 1910–11.

[Elevation, 700 feet.]

Month.	1910	1911	Average, 15 years.	Month.	1910	1911	Average, 15 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	13.87	8.84	6.32	September	2.32	10.24	4.67
February	3.33	11.84	6.34	October	4.85	2.41	5.56
March	9.11	4.41	9.68	November	7.61	6.98	6.67
April	5.48	5.16	6.32	December	16.08	6.76	7.64
May	7.24	4.92	4.59				
June	7.40	7.45	4.12	Annual	91.23	77.73	73.30
July	4.83	3.79	5.33	Mean daily	.250	.213	.198
August	9.11	4.93	6.06				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Spreckelsville (station No. 44), Maui, 1910–11.

[Elevation, 50 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	6.77	2.36	September	0.40	1.10
February	.88	2.49	October	.99	.28
March	1.19	3.10	November	1.05	.00
April	1.35	.87	December	6.61	2.35
May	.69	1.46			
June	.56	.37	Annual	21.46	15.03
July	.23	.31	Mean daily	.058	.041
August	.74	.34			

NOTE.—Gage read daily. Records furnished by Hawaiian Commercial & Sugar Co.

Rainfall at Puunene (station No. 45), Maui, 1910–11.

[Elevation, 73 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.23	4.03	3.15	September	0.11	1.68	0.68
February	.88	4.40	4.01	October	.74	.30	.95
March	.81	3.21	3.33	November	1.03	.....	.....
April	.77	.66	1.55	December	9.44	.....	.....
May	.45	3.25	.64				
June	.68	.32	.27	Annual	21.58	.....	.....
July	.06	.24	.36	Mean daily	.059	[a].060	.....
August	.38	.18	.70				

[a] For 10 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at camp No. 7, Hawaiian Commercial & Sugar Co. (station No. 46), Maui, 1910–11.

[Elevation, 90 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.89	3.97	September	0.00	0.40
February	.56	3.00	October	.18	.00
March	.15	4.35	November	.62	.00
April	.03	.51	December	5.64	.00
May	.03	.78			
June	.08	.00	Annual	11.28	13.01
July	.00	.00	Mean daily	.031	.036
August	.10	.00			

NOTE.—Gage read daily. Records furnished by Hawaiian Commercial & Sugar Co.

Rainfall at Kihei (station No. 47), Maui, 1910.

[Elevation, 55 feet.]

	Inches.		Inches.
January	5.53	June	0.24
February	.79	September	.09
March	.15	October	.00
April	.09		
May	.09	Mean daily	[1].029

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kula (Erehwon, station No. 48), Maui, 1910–11.

[Elevation, 4,200 feet.]

Month.	1910	1911	Average 22 years.	Month.	1910	1911	Average 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.96	6.02	4.75	September	4.61	3.21	2.90
February	2.46	3.35	6.04	October	2.36	2.08	1.95
March	1.03	7.92	4.85	November	.50	.38	2.46
April	.10	3.72	1.73	December	3.84	.50	3.36
May	2.08	5.28	2.79				
June	2.04	.00	1.88	Annual	30.30	35.02	37.90
July	4.10	.31	1.69	Mean daily	.083	.096	.104
August	2.22	2.25	3.50				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waiopae ranch (station No. 49), Maui, 1910–11.

[Elevation, 1,740 feet.]

Month.	1910	1911	Average 14 years.	Month.	1910	1911	Average 14 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	5.84	6.72	2.81	September	0.00	0.00	0.45
February	.00	7.27	5.10	October	.00	2.09	1.12
March	.00	2.68	4.12	November	.00	.00	2.43
April	1.35	1.40	1.62	December	6.26	.00	3.05
May	.00	.00	.86				
June	.00	.00	.18	Annual	15.26	20.16	22.93
July	.00	.00	.33	Mean daily	.042	.055	.063
August	1.81	.00	.86				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Camp (station No. 50), Kahoolawe, 1904–5, and 1911.

[Elevation, 80 feet.]

Month.	1904	1905	1911	Month.	1904	1905	1911
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	.....	0.43	.....	September	.....	0.40	[a] 0.44
February	.....	.77	.....	October	[b] 2.32	.....	[c] .32
March	.....	.54	.....	November	2.40	.....	[d]
April	.....	2.31	.....	December	1.47	.....	[d]
May	.....	.53	.....				
June	.....	1.00	.....	Annual	.....	.....	.....
July	.....	1.54	.....	Mean daily	[e].073	[f].036	[g].058
August	.....	2.34	.....				

[a] Sept. 25–30.
[b] Oct. 8–31.
[c] Oct. 1–7.
[d] No observations made, but rainfall reported as zero.
[e] For 85 days.
[f] For 9 months.
[g] For 13 days.

NOTE.—Records furnished by Eben P. Low.

[1] For eight months.

Rainfall at Reservoir (station No. 51), Kahoolawe, 1911.

[Elevation, 500 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Sept. 30 [a]	6	0.69	0.115
Oct. 7	7	.36	.071
Sept. 30 to Oct. 7	13	1.05	.081

[a] Gage installed Sept. 25.

NOTE.—No observations made from Oct. 7 to Dec. 31, but the rainfall was reported as zero.

Rainfall at Moaula (station No. 52), Kahoolawe, 1911.

[Elevation, 1,100 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Sept. 30 [a]	6	1.13	0.188
Oct. 7	7	.37	.053
Sept. 30 to Oct. 7	13	1.50	.115

[a] Gage installed Sept. 25.

NOTE.—No observations made from Oct. 7 to Dec. 31, but the rainfall was reported as zero.

Rainfall at Kealia (station No. 53), Kahoolawe, 1911.

[Elevation, 600 feet.]

Gage installed October 20, 1911. No observations made from the time gage was installed to December 31, but the rainfall was reported as zero.

Alphabetic list of rainfall stations on islands of Maui and Kahoolawe.

Name.	No.	Elevation.	Name.	No	Elevation.
		Feet.			*Feet.*
Camp No. 7 (Hawaiian Commercial & Sugar Co.)	46	90	Lupi	37	1,160
Haiku	43	700	Mahana	21	1,800
Haleakala ranch	40	2,000	Makawao	41	1,700
Hana	27	145	Mokupea	22	1,000
Honokawai Gulch	18	1,500	Nahiku	28	700
Honokawai power house	19	1,200	Olinda	39	4,000
Honokahau ditch intake	25	806	Olowalu	14	10
Honokahua Gulch	23	760	Olowalu mauka	13	700
Honolua	24	25	Punaluu	35	710
Honomanu	32	1,800	Puu Kukui	15	5,000
Iao Valley, cave	4	1,720	Puu Kukui slope	17	2,500
Iao Valley, gaging station	6	830	Puunene	45	73
Iao Valley, tableland	5	1,500	Puuomalei	42	1,430
Kaanapali	20	12	Spreckelsville	44	50
Kahoma reservoir	16	2,000	Ukulele	38	5,300
Kahoolawe, Camp	50	80	Waiehu	3	375
Kahoolawe, Kealia	53	600	Waihee	2	100
Kahoolawe, Moaula	52	1,100	Waihee tunnels	1	1,550
Kahoolawe, Reservoir	51	500	Waihoi	26	2,200
Kahului	10	8	Waikamoi	34	1,250
Kailua	36	700	Waikamoi mauka	33	4,250
Keanae	30	1,000	Waikapu	12	600
Kihei	47	55	Waikapu tunnel	11	1,535
Kopiliula	29	1,220	Waiopae ranch	49	1,740
Kula (Erehwon)	48	4,200	Wailuku mill	9	180
Kupau camp	31	300	Wailuku mission	8	250
			Wailuku (Penhallow's residence)	7	390

RAINFALL RECORDS ON ISLAND OF HAWAII.

During 1911 investigations were made regarding the amount of precipitation on the windward side of Hawaii in the region supplying the Hilo group of streams, and a series of special rain gages were established from sea level up to elevation of 5,000 feet. While the period included between the date of establishing the stations and the end of December, 1911, was too short to admit of definite conclusions in regard to amount, it was shown that the heaviest rainfall in this region occurs between elevations of 2,000 and 2,500 feet. Additional records obtained in 1912 verify this conclusion and point to 2,200 feet as being the elevation of maximum precipitation.[1]

Records were obtained at stations of high elevation on the northern slope of Mauna Kea and at a number of places around the island near the sea. In all 74 stations were maintained, 38 of which were above 1,000 feet, 13 above 3,000 feet, and 6 above 5,000 feet in elevation. The location of the stations is shown on Plate XV (at end of volume).

In the accompanying tables acknowledgment is made to the United States Weather Bureau for the use of data, and to cooperating parties and observers.

Rainfall stations on island of Hawaii.

	Elevation (feet).		Elevation (feet).
1. Humuula	6,685	24. Waikaumalo	275
2. Puu Oo	6,450	25. Keanakolu	5,500
3. Piihonua mauka	1,900	26. Papaaloa	260
4. Piihonua	1,000	27. Laupahoehoe	100
5. Ponahawai	500	28. Ookala	400
6. Hilo	100	29. Puu Kihe	7,850
7. Waiakea mill	50	30. Hapea mauka	5,000
8. Hilo Breakwater	15	31. Hapea, lower	
9. Mauna Kea, east slope	5,000	32. Umikoa ranch	3,400
10. .....do	4,500	33. Coffee plantation	1,600
11. .....do	4,000	34. Kukaiau office	800
12. .....do	3,500	35. Kukaiau mill	250
13. .....do	3,000	36. Paauilo mauka	300
14. .....do	2,500	37. Paauilo	30
15. .....do	2,000	38. Kalopa	900
16. .....do	1,500	39. Paauhau	1,150
17. .....do	1,000	40. Honokaa mauka	1,100
18. .....do	500	41. Honokaa	470
19. Papaikou	250	42. Kukuihaele (Hawaiian Irrigation Co. weir)	930
20. Pepeekeo	100	43. Kukuihaele	700
21. Hakalau mauka	1,200	44. Kawainui mauka	4,080
22. Hakalau	200	45. Kawainui, lower	1,040
23. Honohina	300		

[1] These are elevations as obtained by aneroid. Accurate determinations made later by topographers of the United States Geological Survey show the correct elevations of the special rain gages to be from 200 to 250 feet greater than were indicated by aneroid. The correct elevation of rainfall station No. 14 at the Geological Survey camp is 2,750 feet.

Rainfall stations on island of Hawaii—Continued.

	Elevation (feet).		Elevation (feet).
46. Alakahi	1,030	61. Napoopoo	25
47. Koiawe	1,000	62. Hoopuloa	2,425
48. Waimea	2,720	63. Kau	1,850
49. Awini	2,100	64. Naalehu [1]	650
50. Honokane	1,042	65. Hilea	310
51. Niulii	200	66. Pahala	850
52. Kohala (Maulili)	960	67. Kapapala ranch	2,150
53. Kohala mission	520	68. Volcano House	3,970
54. Kohala mill	270	69. Mountain View	1,530
55. Hawi mill	600	70. Kurtistown	640
56. Paukea ranch	600	71. Olaa mill	210
57. Puuwaawaa	2,740	72. Pahoa	700
58. Huehue	2,000	73. Kaueleau	1,000
59. Holualoa	1,350	74. Kapoho	110
60. Kealakekua	1,580		

Rainfall at Humuula (station No. 1), Hawaii, 1910–11.

[Elevation, 6,685 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	1.53	6.27	September	0.62	1.16
February	.67	9.35	October	1.29	.30
March	1.56	3.67	November	1.43	2.58
April	.77	3.11	December	.89	2.76
May	1.25	2.55			
June	.93	.79	Annual	15.67	37.15
July	1.32	.94	Mean daily	.043	.102
August	3.41	3.67			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Puu Oo (station No. 2), Hawaii, 1910–11.

[Elevation, 6,450 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	9.33	September	3.08	8.61
February	.....	29.61	October	5.66	2.87
March	.....	7.69	November	5.02	8.70
April	3.01	9.85	December	3.99	9.39
May	4.07	8.94			
June	4.11	4.77	Annual	.....	114.60
July	6.73	2.34	Mean daily	[a] .191	.314
August	16.81	12.50			

[a] For 9 months.

NOTE.—Compiled from U. S. Weather Bureau records.

[1] Evaporation station.

Rainfall at Piihonua mauka (station No. 3), Wailuku River drainage basin, Hawaii, 1911.

[Elevation, 1,900 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches. per day.
1911.				1911.			
Sept. 16[a]	15	15.8	1.05	Nov. 30	15	19.2	1.28
Oct. 16	30	23.5	.78	Dec. 31	31	27.8	.90
31	15	17.0	1.13				
Nov. 15	15	9.4	.63	Sept. 1 to Dec. 31	121	112.7	.93

[a] Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter; installed Sept. 1, 1911.

Rainfall at Piihonua (station No. 4), Wailuku River drainage basin, Hawaii, 1906–1911.

[Elevation, 1,000 feet.]

Month.	1906	1907	1908	1909	1910	1911	Average 6 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	4.08	8.16	11.53	7.30	22.99	16.05	11.68	22.99	4.08
February	2.81	14.25	24.70	11.73	4.84	32.96	15.22	32.96	2.81
March	1.52	18.31	7.04	37.01	21.97	14.85	16.78	37.01	1.52
April	13.32	8.19	20.87	5.79	16.79	25.25	15.04	25.25	5.79
May	14.15	8.70	14.28	16.64	17.76	20.70	15.37	20.70	8.70
June	7.24	11.38	8.86	7.35	21.96	17.41	12.37	21.96	7.24
July	12.90	14.37	10.10	18.51	14.95	9.62	13.41	18.51	9.62
August	25.32	49.91	13.64	5.96	21.95	15.54	22.05	49.91	5.96
September	6.94	27.22	23.48	11.29	4.94	22.18	16.01	27.22	4.94
October	5.15	19.12	15.72	8.81	10.46	11.37	11.77	19.12	5.15
November	20.83	13.90	7.77	4.80	15.46	16.64	13.23	20.83	4.80
December	15.57	6.20	25.32	21.26	19.41	19.07	17.80	25.32	6.20
Annual	129.83	199.71	183.31	156.45	193.48	221.64	180.73	221.64	129.83
Mean daily	.36	.55	.50	.43	.53	.61	.495	.61	.36

NOTE.—Readings made daily.
Records furnished by James Henderson.

Rainfall at Ponahawai (station No. 5), Hawaii, 1910–11.

[Elevation, 500 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	20.93	14.79	September	7.22	18.71
February	3.83	26.84	October	8.66	10.11
March	23.33	11.98	November	14.41	17.20
April	16.15	21.57	December	19.58	19.11
May	16.80	18.76			
June	19.16	16.27	Annual	184.94	196.69
July	12.69	7.85	Mean daily	.507	.539
August	22.18	13.50			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hilo (station No. 6), Hawaii, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Average, 25 years.	Month.	1910	1911	Average, 25 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	15.89	15.79	9.39	September	3.96	22.97	10.66
February	2.87	18.73	11.77	October	2.64	7.34	10.97
March	17.73	13.86	16.02	November	9.94	13.42	13.09
April	10.40	18.20	13.67	December	15.36	15.01	11.24
May	13.02	15.56	9.60				
June	12.21	11.29	7.10	Annual	132.64	168.39	136.53
July	10.44	6.03	10.46	Mean daily	.364	.461	.374
August	18.18	10.19	12.56				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waiakea mill (station No. 7), Hawaii, 1910–11.

[Elevation, 50 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	16.10	15.76	9.68	September	5.25	14.47	10.62
February	2.48	15.61	9.57	October	7.96	7.43	11.27
March	13.17	12.13	15.60	November	10.87	12.88	12.22
April	9.35	15.23	12.34	December	14.12	14.38	10.39
May	12.20	15.04	9.30				
June	11.55	10.46	6.46	Annual	129.59	146 63	129.30
July	10.43	5.13	9.29	Mean daily	.355	.402	.354
August	16.11	8.11	12.56				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hilo breakwater (station No. 8), Hawaii, 1911.

[Elevation, 15 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1911.				1911.			
Aug. 15[a]	26	1.9	0.07	Dec. 11	21	8.4	0.40
23	8	3.1	.39	20	9	7.6	.84
Sept. 1	9	2.2	.24	1912.			
19	18	4.0	.22	Jan. 2	13	3.4	.26
28	9	9.4	1.04				
Oct. 10	12	8.4	.70	July 20, 1911, to Jan. 2, 1912[b]	166	57.2	.34
13	3	.2	.07				
20	7	1.0	.14				
Nov. 20	31	7.6	.25				

[a] Special gage, 50-inch capacity; receiver, 5.94 inches diameter; container, 8.40 inches diameter. Installed July 20, 1911.

[b] United States Engineer Department gage, at same location, but read daily for same period, gave 58.76 inches, or 0.35 inch per day. Total for calendar year recorded by Engineer Department gage was 147.12 inches.

Rainfall on east slope of Mauna Kea (station No. 9), Hawaii.

[Elevation, 5,000 feet.]

Special gage, capacity 125 inches; receiver 5.94 inches diameter, container 13.28 inches diameter, was installed December 31, 1911. Records obtained early in 1912 indicate that the precipitation at this station is less than that at station No. 10.

Rainfall on east slope of Mauna Kea (station No. 10), Hawaii, 1911.

[Elevation, 4,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Nov. 3 to Dec. 31	58	41.0	0.71

NOTE.—Special gage, capacity 125 inches; receiver 5.94 inches diameter, container 13.28 inches diameter, installed Nov. 3, 1911.

Rainfall on east slope of Mauna Kea (station No. 11), Hawaii, 1911.

[Elevation, 4,000 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Nov. 3 to Dec. 31	58	39.0	0.67

NOTE.—Special gage, capacity 125 inches; receiver 5.94 inches diameter, container 13.28 inches diameter, installed Nov. 3, 1911.

Rainfall on east slope of Mauna Kea (station No. 12), Hawaii, 1911.

[Elevation, 3,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Nov. 4 to Dec. 31	57	42.5	0.75

NOTE.—Special gage, capacity 125 inches; receiver 5.94 inches diameter, container 13.28 inches diameter, installed Nov. 4, 1911.

Rainfall on east slope of Mauna Kea (station No. 13), Hawaii, 1911.

[Elevation, 3,000 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
Aug. 30 [a]	54	32.5	0.60
Nov. 2 [b]	64	47.5	.74
Dec. 31	59	57.5	.98
July 7 to Dec. 31	177	137.5	.78

[a] Special gage, capacity 125 inches; receiver 5.94 inches diameter, container 13.28 inches diameter, installed July 7, 1911, at 2,800 feet elevation.
[b] Gage moved to 3,000 feet elevation.

Rainfall on east slope of Mauna Kea (station No. 14), Hawaii, 1911.

[Elevation, 2,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1911.				1912.			
July 1 [a]	1	0.8	0.80	Jan. 1	31	35.6	1.15
July 26	25	17.4	.70				
Aug. 29 [b]	34	19.0	.56	June 30, 1911, to Jan. 1, 1912	185	169.4	.92
Sept. 6	8	12.4	1.55				
Sept. 30	24	30.8	1.28				
Nov. 1	32	20.0	.62				
Dec. 1	30	33.4	1.11				

[a] Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter, installed June 30, 1911, at 2,350 feet elevation.
[b] Gage moved to 2,500 feet elevation.

NOTE.—A standard United States Weather Bureau type of gage was established Sept. 6 by the side of the special gage, the receivers of the two gages being at the same level. This gage was read daily so far as possible. (See p. 349 for daily readings.) The totals for the periods included between readings of the special gage were as follows: For 24 days ending Sept. 30, 30.40 inches; for 32 days ending Nov. 1, 19.61 inches; for 30 days ending Dec. 1, 32.89 inches; for 31 days ending Jan. 1, 1912, 31.20 inches. Same error evidently occurred in reading the daily gage during December, due to inexperience of observers.

Rainfall on east slope of Mauna Kea (station No. 15), Hawaii, 1911.

[Elevation, 2,000 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1911.				1912.			
June 29	36	32.4	0.90	Jan. 1	31	31.0	1.00
July 1	2	1.8	.90				
July 26	25	18.4	.74	May 24, 1911, to Jan. 1 1912	222	201.6	.91
Aug. 29	34	19.6	.58				
Sept. 30	32	47.0	1.47				
Nov. 1	32	23.0	.72				
Dec. 1	30	28.4	.95				

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter, installed May 24, 1911.

Rainfall on east slope of Mauna Kea (station No. 16), Hawaii, 1911.

[Elevation, 1,500 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1911.				1912.			
June 23	31	26.8	0.86	Jan. 1	31	19.6	.63
July 26	33	21.2	.64				
Aug. 28	33	16.4	.50	May 23 1911, to Jan. 1, 1912	223	166.7	.75
Sept. 30	33	39.0	1.18				
Nov. 1	32	19.7	.62				
Dec. 1	30	24.0	.80				

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter, installed May 23, 1911.

Rainfall on east slope of Mauna Kea (station No. 17), Hawaii, 1911.

[Elevation, 1,000 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1911.				1912.			
July 26	37	17.4	0.47	Jan. 1	31	15.6	.50
Aug. 31	36	16.2	.45				
Sept. 30	30	24.2	.81	June 19, 1911, to Jan. 1 1912	196	104.5	.53
Nov. 1	32	13.3	.42				
Dec. 1	30	17.8	.59				

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter, installed June 19, 1911.

Rainfall on east slope of Mauna Kea (station No. 18), Hawaii, 1911.

[Elevation, 500 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1911.				1912.			
Aug. 31	41	11.8	0.29	Jan. 1	31	14.6	0.47
Sept. 30	30	18.8	.63				
Nov. 1	32	9.9	.31	July 21, 1911, to Jan. 1, 1912	164	69.1	.42
Dec. 1	30	14.0	.47				

NOTE.—Special gage, 50-inch capacity; receiver 5.94 inches diameter, container 8.40 inches diameter, installed July 21, 1911.

Rainfall at Papaikou (station No. 19), Hawaii, 1910–11.

[Elevation, 250 feet.]

Month.	1910	1911	Average 13 years.	Month.	1910	1911	Average 13 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	26.87	22.09	11.49	September	7.47	21.41	15.29
February	4.62	18.18	11.19	October	9.79	10.55	13.90
March	21.44	13.30	20.25	November	15.51	19.57	18.70
April	14.15	20.83	15.87	December	18.03	18.05	14.29
May	17.56	19.33	13.86				
June	14.74	14.99	9.16	Annual	183.50	202.98	175.49
July	14.47	13.64	13.98	Mean daily	.503	.553	.481
August	18.85	11.04	17.51				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Pepeekeo (station No. 20), Hawaii, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Average 22 years.	Month.	1910	1911	Average 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	19.78	15.34	10.93	September	4.45	14.90	10.82
February	4.87	12.52	9.33	October	7.83	8.63	10.34
March	13.91	11.81	16.50	November	10.46	12.13	11.79
April	6.55	12.06	10.29	December	17.01	9.60	11.50
May	9.29	16.35	8.59				
June	11.10	10.71	6.34	Annual	126.51	139.73	128.32
July	7.67	8.35	9.80	Mean daily	.344	.383	.352
August	13.59	7.33	12.09				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hakalau mauka (station No. 21), Hakalau Stream drainage basin, Hawaii, 1910–11.

[Elevation, 1,200 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	33.27	35.56	September	9.82	35.12
February	9.11	51.30	October	16.71	15.05
March	30.29	19.83	November	23.63	29.44
April	26.03	33.74	December	38.02	23.88
May	26.60	29.15			
June	29.87	32.74	Annual	299.03	359.68
July	23.55	21.02	Mean daily	.820	.985
August	32.13	32.85			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hakalau (station No. 22), Hakalau Stream drainage basin, Hawaii, 1910–11.

[Elevation, 200 feet.]

Month.	1910	1911	Average 20 years.	Month.	1910	1911	Average 20 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	17.53	18.94	10.54	September	7.68	19.93	11.87
February	5.57	23.13	10.14	October	5.34	14.16	10.09
March	16.36	11.09	16.78	November	9.41	14.20	13.66
April	9.79	16.84	12.20	December	19.75	12.40	10.77
May	9.35	15.24	9.46				
June	12.72	15.12	6.66	Annual	139.32	184.39	134.92
July	10.99	10.50	9.71	Mean daily	.382	.505	.370
August	14.83	12.84	13.04				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Honohina (station No. 23), Hawaii, 1910–11.

[Elevation, 300 feet.]

Month.	1910	1911	Average, 18 years.	Month.	1910	1911	Average, 18 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	16.35	19.43	11.58	September	6.51	19.18	12.57
February	5.78	21.99	9.99	October	7.31	9.54	11.08
March	19.32	11.07	20.37	November	12.49	11.56	15.38
April	7.63	15.75	13.45	December	23.48	9.83	11.32
May	12.49	18.34	10.88				
June	13.30	14.09	7.04	Annual	151.49	172.56	147.29
July	10.68	10.55	9.79	Mean daily	.415	.473	.404
August	16.15	11.23	13.84				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Waikaumalo (station No. 24), Hawaii, 1910–11.

[Elevation, 275 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	16.68	22.61	September	4.78	22.64
February	7.05	26.48	October	8.69	9.97
March	18.33	10.56	November	13.11	14.67
April	10.96	21.65	December	28.22	13.58
May	15.01	20.00			
June	14.62	15.38	Annual	166.99	202.28
July	11.67	12.56	Mean daily	.458	.552
August	17.87	12.18			

NOTE.—Compiled from U. S Weather Bureau records.

Rainfall at Keanakolú (station No. 25), Hawaii, 1910–11.

[Elevation, 5,500 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	14.19	13.41	September	1.75	6.67
February	2.10	51.85	October	6.22	3.04
March	7.74	4.38	November	6.10	9.69
April	8.55	13.67	December	10.42	11.79
May	5.68	7.91			
June	3.88	3.60	Annual	72.79	135.29
July	2.18	2.89	Mean daily	.195	.371
August	3.98	6.39			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Papaaloa (station No. 26), Hawaii, 1910–11.

[Elevation, 260 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	15.51	16.94	September	7.11	17.61
February	6.50	18.53	October	6.78	4.86
March	12.19	7.37	November	11.15	13.93
April	9.18	16.06	December	25.48	10.77
May	10.40	11.47			
June	12.71	11.51	Annual	140.90	149.37
July	9.08	10.69	Mean daily	.386	.409
August	14.81	9.63			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Laupahoehoe (station No. 27), Hawaii, 1910–11.

[Elevation, 100 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	16.75	15.60	11.00	September	4.31	18.54	9.44
February	6.01	21.99	10.46	October	9.84	5.11	10.51
March	15.15	6.74	21.66	November	9.92	11.40	12.62
April	8.03	20.85	17.32	December	22.54	13.92	14.55
May	10.88	14.83	9.46				
June	15.19	19.70	7.16	Annual	135.80	167.79	149.43
July	9.84	9.64	12.21	Mean daily	.372	.460	.409
August	7.34	9.47	13.04				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Ookala (station No. 28), Hawaii, 1910–11.

[Elevation, 400 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	16.82	13.24	9.75	September	2.07	14.18	6.20
February	6.70	23.50	8.41	October	9.32	3.90	8.30
March	10.80	9.36	17.22	November	12.48	10.53	11.26
April	7.66	16.88	11.72	December	25.30	8.01	11.83
May	11.47	11.07	7.00				
June	10.90	11.20	4.86	Annual	135.02	138.12	114.09
July	8.55	8.26	8.01	Mean daily	.370	.378	.313
August	12.95	7.99	9.53				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Puu Kihe (station No. 29), on northern slope of Mauna Kea, Hawaii, 1903–11.

[Elevation, 7,850 feet.]

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1903.				1908.			
Mar. 1				Feb. 6	166	3.85	0.02
June 10	101	7.10	0.07	19	13	3.01	.23
July 31	51	2.00	.04	Apr. 18	59	3.35	.06
Aug. 6	6	4.60	.77	May		None.	.00
Oct. 24	79	2.60	.03	June		None.	.00
Nov. 19	26	3.50	.13	July		None.	.00
				Aug.		None.	.00
Mar. 1 to Nov. 19, 1903	263	19.80	.075	Sept. 22		None.	.00
				Oct. 31	39	11.10	.28
1904.						1.20	
Jan. 1				Nov. 29		1.51	
Feb. 23	53	26.70	.50	Dec. 2	3	10.85	3.62
Apr. 27	64	13.10	.21				
Aug. 22	117	1.10	.01	Aug. 24, 1907, to Dec. 2, 1908	466	34.87	.075
23	1	.10	.10				
27	4	.10	.02	1909.			
				Feb. 20	80	7.05	.09
Jan. 1 to Aug. 27, 1904	239	41.10	.172	Mar. 26	34	8.00	.24
				Apr. 16	21	3.50	.17
1905.				Aug. 6	112	2.32	.02
Apr. 11	227	.60	.003	Sept. 8	33	1.40	.04
Aug. 21	132	8.10	.06				
Sept. 11	21	5.65	.27	Dec. 2, 1908, to Sept. 8, 1909	280	22.27	.080
Nov. 18	68	8.35	.12				
				1910.			
Aug. 27, 1904, to Nov. 18, 1905	448	22.70	.051	Jan. 21	135	1.97	.01
				Feb. 28	38	1.08	.03
1906.				Apr. 4	35	4.45	.13
Feb. 16	90	3.75	.04	19	15	.56	.04
June 28	132	9.24	.07	Oct. 12	176	8.60	.05
Aug. 16	49	10.82	.22	Nov. 26	45	2.51	.06
Nov. 16	92	3.75	.04	Dec. 31	35	3.27	.09
Dec. 15	29	6.00	.21				
24	9	4.22	.47	Sept. 8, 1909, to Dec. 31, 1910	479	22.44	.047
Nov. 18, 1905, to Dec. 24, 1906	401	37.78	.094	1911.			
				Jan. 2	2	5.38	2.69
1907.				20	18	4.00	.22
Feb. 9	47	2.12	.05	Feb. 17	28	24.95	.89
Apr. 24	74	5.80	.08	May 31	103	17.45	.17
Aug. 24	122	24.00	.20	Aug. 31	92	6.75	.07
				Oct. 23	53	3.58	.07
Dec. 24, 1906, to Aug. 24, 1907	243	31.92	.131	Nov. 22	30	2.19	.07
				Dec. 31, 1910, to Nov. 22, 1911	326	64.30	.197

NOTE.—Records furnished by Kukaiau Plantation Co. (Ltd.), Kukaiau, Hawaii.

Rainfall at Hapea mauka, on northern slope of Mauna Kea (station No. 30), Hawaii, 1902–1911.

[Elevation, 5,000 feet.]

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
1902.			
Mar. 31	30	27.01	0.90
Apr. 10	10	1.66	.17
28	18	3.30	.18
May 14	16	9.00	.56
24	10	.60	.06
June 17	24	1.15	.05
—	.....	1.60	.....
July —	.....	.60	.....
Aug. 15	.....	.60	.....
Sept. 16	32	.70	.02
27	11	.22	.02
Oct. 16	19	.34	.02
Nov. 15	30	2.90	.10
22	7	3.60	.51
Dec. 25	33	1.50	.04
Mar. 1 to Dec. 25, 1902	300	54.78	.183
1903.			
Mar. 14	.....	7.70	.....
19	.....	.....	.....
31	12	30.00	2.50
Apr. 24	24	.30	.01
May 2	8	.50	.06
July 15	74	.60	.01
Aug. 7	23	1.42	.06
Oct. 9	63	1.60	.03
Mar. 14 to Oct. 9, 1903	.....	42.12	.....
1904.			
Jan. 1	.....	.....	.....
Feb. 15	45	16.00	.36
Mar. 28	41	4.20	.10
Apr. 13	16	7.50	.47
Aug. 29	138	6.40	.05
Sept. 23	25	2.25	.09
Oct. 31	38	.90	.02
Jan. 1 to Oct. 31, 1904	303	37.25	.123
1905.			
Jan. 30	.....	.76	.....
Mar. 21	50	2.84	.06
May 26	66	.83	.01
June 21	26	1.00	.04
July 12	21	.25	.01
14	2	.48	.24
21	7	2.00	.29
22	1	.34	.34
Aug. 4	13	.04	.003
31	27	1.65	.06
Sept. 9	9	1.94	.22
30	21	2.75	.13
Nov. 11	42	.48	.01
Dec. 16	35	1.25	.04
Jan. 30 to Dec. 16, 1905	.....	16.61	.....

Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.
1906.			
Jan. 20	35	1.20	0.03
Mar. 20	59	.31	.005
Apr. 12	23	1.70	.07
July 23	102	.40	.04
Aug. 9	17	4.90	.29
30	21	.10	.005
Sept. 25	26	.60	.02
Oct. 6	11	1.36	.12
Dec. 25	80	6.44	.08
Dec. 16, 1905, to Dec. 25, 1906	374	17.01	.045
1907.			
Jan. 12	18	4.88	.27
Mar. 20	67	5.02	.07
May 6	47	3.00	.06
31	25	.90	.04
June 21	21	1.90	.09
July 22	31	2.80	.09
Aug. 29	38	2.47	.06
Oct. 14	46	5.90	.13
Nov. 7	24	.74	.03
Dec. 25, 1906, to Nov. 7, 1907	317	27.61	.087
1908.			
Mar. 18	.....	4.90	.....
Apr. —	.....	None.	.....
May —	.....	None.	.....
June —	.....	None.	.....
July —	.....	None.	.....
Aug. —	.....	None.	.....
Sept. 14	.....	0.83	.....
Oct. —	.....	None.	.....
Nov. 29	.....	1.51	.....
Dec. 25 and 26	.....	7.50	.....
Mar. 18 to Dec. 26, 1908	.....	14.74	.....
1909.			
Jan. 13	18	2.57	.14
18	5	.08	.02
Feb. 18	31	2.25	.07
Apr. 16	57	3.10	.05
July 27	102	.58	.006
Sept. 8	43	.20	.05
Nov. 14	67	1.22	.02
15	1	.25	.25
Dec. 27	42	8.75	.21
Dec. 26, 1908, to Dec. 27, 1909	366	19.00	.052
1910.			
Jan. 6	10	.25	.02
Feb. 3	28	.84	.03
13	10	.95	.10
Mar. 22	37	.67	.02
Apr. 4	13	2.49	.19
18	14	.28	.20

Rainfall at Hapea mauka, on northern slope of Mauna Kea (station No. 30), Hawaii, 1902–1911—Continued.

Date of observation.	Period (days).	Recorded rainfall.		Date of observation.	Period (days).	Recorded rainfall.	
		Inches.	Inches per day.			Inches.	Inches per day.
1910.				1911.			
May 10	22	0.23	0.01	Jan. 3	9	3.56	0.40
30	20	.38	.02	28	25	4.90	.20
June 7	8	.17	.02	Feb. 11	14	20.05	1.43
July 5	28	1.17	.04	Mar. 18	35	2.50	.07
Aug. 22	48	.91	.02	27	9	1.63	.18
29	7	.60	.09	31	4	1.80	.45
Sept. 24	26	.54	.02	Apr. 26	26	3.75	.14
Oct. 17	23	1.65	.07	May 9	13	.88	.07
Nov. 26	40	.....	.....	June 2	24	3.79	.16
Dec. 5	9	4.70	.52	Aug. 25	84	2.23	.03
15	10	1.26	.13	Sept. 6	12	1.65	.14
25	10	.40	.04	Nov. 21	76	2.18	.03
				Dec. 23	32	2.20	.07
Dec. 27, 1909, to Dec. 25, 1910	363	17.49	.048	Dec. 25, 1910, to Dec. 23, 1911	363	51.12	.141

NOTE.—Records furnished by Kukaiau Plantation Co. (Ltd.), Kukaiau, Hawaii.

Rainfall at lower Hapea (station No. 31), on northern slope of Mauna Kea, Hawaii, 1909–1911.

Month.	1909	1910	1911	Month.	1909	1910	1911
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	.....	9.00	11.80	September	0.08	0.25	3.72
February	.....	4.98	20.00	October	.97	3.18	1.55
March	.....	.85	9.36	November	1.00	.75	3.90
April	4.90	8.05	5.86	December	13.35	18.51	5.07
May	.40	.98	4.90				
June	.31	1.08	3.62	Annual	.....	49.70	73.13
July	.86	.32	.00	Mean daily	[a].082	.136	.200
August	.71	1.75	3.35				

[a] For 9 months.

NOTE.—Records furnished by Kukaiau Plantation Co. (Ltd.), Kukaiau, Hawaii.

Rainfall at Umikoa ranch (station No. 32), on northern slope of Mauna Kea, Hawaii, 1894–1911.

[Elevation, 3,400 feet.]

Month.	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	2.44	4.81	3.18	18.39	0.78	4.25	7.10	2.77	15.23	26.50
February	.....	5.09	13.16	.97	3.49	.22	9.97	8.38	2.55	7.47	5.98
March	.....	29.02	18.05	.55	21.96	9.77	.99	17.10	78.30	11.00	5.78
April	1.64	16.70	6.61	1.38	3.43	14.00	6.97	2.90	22.77	5.03	21.24
May	.00	.08	2.16	.13	1.80	5.72	3.44	.00	7.08	.10	.79
June	.15	.33	.57	.00	2.68	.53	1.92	.00	4.88	1.03	.00
July	1.40	2.66	2.07	.23	.68	1.20	1.58	.00	.06	7.22	1.44
August	.74	10.45	8.99	.86	.64	.45	1.30	.07	9.88	.72	1.30
September	.46	2.27	.13	.50	.51	.00	.00	.00	2.52	1.50	6.42
October	1.14	3.00	1.48	.67	.77	15.45	5.96	2.87	5.68	5.05	.86
November	19.87	7.90	1.78	5.72	1.21	1.54	10.25	11.14	10.86	11.59	3.85
December	25.25	.33	5.35	5.11	5.24	.00	5.74	10.86	35.24	.00	4.37
Annual	.....	80.27	65.16	19.30	60.80	49.66	52.37	60.42	182.59	65.94	78.53
Mean daily	[a].18	.22	.18	.05	.17	.14	.14	.17	.50	.18	.21

Rainfall at Umikoa ranch (station No. 32), on northern slope of Mauna Kea, Hawaii, 1894–1911—Continued.

Month.	1905	1906	1907	1908	1909	1910	1911	Average, 17 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	2.96	1.29	1.10	5.31	2.47	16.22	12.49	7.49	26.50	0.78
February	.35	.45	12.12	7.13	6.39	5.83	43.44	7.82	43.44	.22
March	7.91	3.17	7.06	3.07	18.63	4.97	3.30	14.15	78.30	.55
April	9.36	3.08	14.29	2.45	12.19	11.40	11.74	9.29	22.77	1.38
May	2.94	4.99	2.12	1.79	1.50	6.64	9.49	2.82	9.49	.00
June	1.68	.35	.67	.00	.95	3.27	3.24	1.24	4.88	.00
July	4.55	4.28	5.75	.33	2.27	1.50	2.53	2.21	7.22	.00
August	3.91	2.61	25.29	3.32	.62	3.05	3.69	4.33	25.29	.07
September	18.94	1.13	4.55	7.66	1.61	2.22	3.77	3.01	18.94	.00
October	1.94	4.44	5.34	2.42	3.55	4.24	3.39	3.79	15.45	.67
November	6.06	2.32	1.33	14.34	1.36	9.50	4.72	6.96	19.87	1.21
December	3.44	24.37	.00	25.11	15.24	14.28	5.71	10.31	35.24	.00
Annual	63.44	52.48	79.62	73.02	66.78	83.13	107.51	73.42	182.59	19.30
Mean daily	.17	.14	.22	.20	.18	.23	.29	.201	.50	.05

[a] For 9 months.

NOTE.—Records furnished by Kukaiau Plantation Co. (Ltd.), Kukaiau, Hawaii.

Rainfall at Coffee plantation on northern slope of Mauna Kea (station No. 33), Hawaii, 1895–1905.

[Elevation, 1,600 feet.]

Month.	1895	1896	1897	1898	1899	1900	1901
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	6.31	12.84	7.35	34.28	0.00	4.67	12.07
February	10.32	14.46	5.13	4.95	.30	7.61	9.91
March	28.21	20.43	3.83	33.52	19.05	3.72	28.63
April	39.48	12.84	4.31	8.87	17.78	12.78	2.56
May	5.86	10.56	1.16	5.68	5.94	11.88	.00
June	1.25	6.26	.35	1.90	2.00	2.88	.00
July	9.65	3.93	2.08	5.21	4.73	3.98	.75
August	7.77	9.37	5.70	5.30	4.73	3.95	.60
September	6.92	1.20	.67	1.57	1.18	.43	.60
October	3.67	6.12	1.57	4.40	22.92	8.20	5.11
November	11.54	1.20	9.08	4.90	8.87	21.13	17.13
December	.57	19.90	9.28	9.40	.00	5.84	6.34
Annual	131.55	119.11	50.51	119.98	87.50	87.07	83.70
Mean daily	.36	.33	.14	.33	.24	.24	.23

Month.	1902	1903	1904	1905	Average, 11 years.[a]	Maximum.[a]	Minimum.[a]
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	3.20	28.32	20.09	10.94	12.73	34.28	0.00
February	4.54	17.38	7.42	8.96	8.27	17.38	.30
March	87.91	12.04	3.64	23.42	124.04	33.52	3.64
April	16.03	13.03	49.65	16.51	7.62	49.65	2.56
May	36.38	2.36	3.11	6.56	8.14	36.38	.00
June	12.85	.69	3.38	3.54	3.19	12.85	.00
July	2.05	14.93	11.90	6.12	5.94	14.93	.75
August	31.72	2.86	2.16	7.73	7.44	31.72	.60
September	8.06	1.56	3.81	4.01	2.73	8.06	.43
October	9.96	8.57	1.68	6.75	7.18	22.92	1.57
November	19.56	21.77	9.24	12.69	12.46	21.77	4.90
December	34.89	5.00	3.88	10.02	9.56	34.89	.00
Annual	267.15	128.51	119.96	117.25	119.30	267.15	50.51
Mean daily	.73	.35	.33	.32	.327	.73	.14

[a] For 11-year period, 1895–1905.

NOTE.—Records furnished by Kukaiau Plantation Co. (Ltd.), Kukaiau, Hawaii.

Rainfall at Kukaiau Plantation Co. office (station No. 34), on northern slope of Mauna Kea, Hawaii, 1895–1911.

[Elevation, 800 feet.]

Month.	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	5.73	10.42	6.21	28.37	0.33	5.12	5.60	4.31	19.53	17.99
February	7.88	16.25	5.82	4.85	1.64	9.96	8.86	4.72	12.34	8.77
March	10.28	12.15	3.72	23.88	21.23	5.48	22.48	59.41	10.72	3.39
April	10.01	12.21	3.52	7.41	8.45	7.11	3.00	12.32	19.49	43.83
May	2.72	6.89	.84	4.71	3.54	12.07	.00	22.15	1.96	5.52
June	1.81	7.17	3.48	2.80	2.63	3.04	.14	7.07	.65	1.88
July	4.75	4.33	6.65	5.91	4.63	2.43	.67	2.02	12.60	14.66
August	7.13	7.11	.90	4.23	7.53	3.99	.28	18.44	3.80	3.85
September	6.52	1.91	1.35	1.16	3.05	1.54	.26	5.91	2.21	4.10
October	4.99	4.91	8.69	2.94	16.87	7.06	4.32	6.61	7.86	1.31
November	10.70	1.01	1.52	2.87	7.90	15.61	14.68	15.66	17.07	9.60
December	1.26	5.32	6.48	6.69	.06	4.20	14.75	27.18	3.67	3.31
Annual	83.78	89.78	49.18	95.82	77.86	77.61	75.04	185.80	111.90	118.21
Mean daily	.23	.24	.13	.26	.21	.21	.21	.51	.30	.32

Month.	1905	1906	1907	1908	1909	1910	1911	Average, 17 years.	Max.	Min.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches*	*Inches.*	*Inches.*	*Inches.*
January	6.88	0.91	3.17	5.82	6.27	16.58	13.06	9.19	28.37	0.33
February	4.56	2.95	9.78	6.97	9.17	5.60	35.20	9.13	35.20	1.64
March	15.16	3.26	13.54	2.60	28.00	10.17	8.22	14.92	59.41	2.60
April	10.04	10.57	11.20	9.75	12.36	10.94	13.11	12.67	43.83	3.00
May	6.78	7.01	2.86	3.80	5.88	11.28	11.08	6.42	22.15	.00
June	4.87	1.49	2.36	2.01	3.95	11.92	11.94	4.07	11.94	.14
July	7.50	9.21	11.02	5.80	6.01	5.27	5.34	6.40	14.66	.67
August	10.71	11.19	27.77	6.51	1.74	8.61	8.30	7.77	27.77	.28
September	15.02	2.43	12.55	6.86	2.83	2.17	12.61	4.85	15.02	.26
October	9.82	1.38	9.41	5.49	3.48	5.80	2.87	6.11	16.87	1.31
November	11.27	6.33	5.62	11.41	3.48	9.43	11.55	9.16	17.07	1.01
December	8.70	18.15	4.20	15.10	8.75	18.77	10.03	9.21	27.18	.06
Annual	111.25	74.88	113.48	82.12	91.92	116.54	143.31	99.91	185.80	49.18
Mean daily	.30	.20	.31	.22	.25	.32	.39	.274	.51	.13

NOTE.—Readings made daily. Records furnished by Kukaiau Plantation Co. (Ltd.), Kukaiau, Hawaii.

Rainfall at Kukaiau mill (station No. 35), Hawaii, 1910–11.

[Elevation, 250 feet.]

Month.	1910	1911	Average, 19 years.	Month.	1910	1911	Average, 19 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	14.34	12.15	7.42	September	1.50	10.27	4.44
February	5.16	22.72	7.97	October	4.80	2.78	5.14
March	6.89	8.48	13.78	November	9.67	8.99	8.52
April	4.91	13.00	10.94	December	17.98	8.43	8.09
May	9.34	8.64	5.10				
June	7.33	8.14	3.37	Annual	94.13	114.57	87.60
July	4.45	4.70	5.71	Mean daily	.258	.314	.240
August	7.76	6.27	7.12				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Paauilo (station No. 36), Hawaii, 1910–11.

[Elevation, 300 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	14.60	10.08	September	1.90	9.64
February	6.07	23.04	October	5.91	2.65
March	9.18	8.65	November	10.86	8.72
April	7.81	11.22	December	7.14	7.46
May	9.80	8.80			
June	9.43	8.83	Annual	96.93	109.80
July	4.85	4.46	Mean daily	.265	.301
August	9.38	6.25			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Paauhau (station No. 37), Hawaii, 1910–11.

[Elevation, 300 feet.]

Month.	1910	1911	Average, 22 years.	Month.	1910	1911	Average, 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	10.24	10.58	6.44	September	0.68	7.69	2.98
February	5.91	18.53	6.44	October	5.47	2.39	3.86
March	5.04	7.49	9.94	November	7.57	6.83	6.10
April	6.38	8.48	6.76	December	15.25	4.91	6.93
May	7.11	7.67	3.76				
June	6.97	6.45	2.73	Annual	79.61	88.32	65.97
July	3.79	2.93	4.67	Mean daily	.218	.242	.181
August	5.20	4.37	5.36				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kalopa (station No. 38), Hawaii, 1910–11.

[Elevation, 900 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	15.93	10.53	September	0.55	9.56
February	7.57	26.47	October	6.23	2.82
March	10.53	8.31	November	11.05	8.76
April	7.95	11.95	December	20.44	7.04
May	10.21	10.32			
June	6.66	9.21	Annual	108.33	114.56
July	4.71	4.20	Mean daily	.300	.314
August	6.50	5.39			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Paauhau mauka (station No. 39), Hawaii, 1910.

[Elevation, 1,150 feet.]

	Inches.		Inches.
January	14.97	June	10.73
February	6.28	July	4.03
March	8.85	August	7.44
April	10.99	September	1.73
May	11.52	Mean daily (for 9 months)	.280

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Honokaa mauka (station No. 40), Hawaii, 1910–11.

[Elevation, 1,100 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	12.50	13.38	9.12	September	1.30	11.56	6.07
February	10.70	30.90	9.76	October	5.87	3.02	4.66
March	6.25	8.54	12.54	November	11.40	8.96	9.87
April	8.70	9.35	13.20	December	21.85	8.19	11.42
May	8.70	9.35	5.96				
June	7.85	11.49	4.00	Annual	105.15	125.45	101.80
July	4.10	4.37	6.78	Mean daily	.288	.344	.279
August	5.93	6.14	8.42				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Honokaa (station No. 41), Hawaii, 1910–11.

[Elevation, 470 feet.]

Month.	1910	1911	Average, 22 years.	Month.	1910	1911	Average, 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	10.30	9.44	6.75	September	0.98	7.68	3.41
February	6.88	20.11	6.66	October	5.87	2.54	3.91
March	5.73	6.77	10.24	November	7.84	6.95	6.47
April	6.23	7.94	6.77	December	16.01	5.50	7.63
May	7.85	7.74	3.91				
June	6.12	7.29	2.84	Annual	83.81	89.47	68.97
July	4.34	2.77	4.80	Mean daily	.236	.245	.189
August	5.66	4.74	5.58				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kukuihaele (station No. 42), Hawaiian Irrigation Co. weir, Hawaii, 1910–11.

[Elevation, 930 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	11.29	September	1.75	8.97
February	.....	18.19	October	5.85	3.31
March	.....	7.80	November	6.55	5.35
April	.....	9.72	December	14.38	5.10
May	.....	9.72			
June	.....	6.85	Annual	.....	96.53
July	.....	4.21	Mean daily	[a] .23	.26
August	.....	6.02			

[a] For 4 months.

NOTE.—Readings made daily. Records furnished by Hawaiian Irrigation Co. (Ltd.), Kukuihaele, Hawaii.

Rainfall at Kukuihaele (station No. 43), Hawaii, 1910–11.

[Elevation, 700 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	8.55	12.13	6.63	September	1.96	9.53	4.05
February	9.58	20.18	6.74	October	6.01	3.24	4.32
March	5.13	6.75	9.82	November	7.31	5.63	6.47
April	6.69	10.06	8.40	December	15.14	5.78	7.44
May	7.02	9.10	4.55				
June	7.96	7.09	3.19	Annual	87.49	100.05	73.07
July	6.89	4.35	5.47	Mean daily	.240	.274	.200
August	5.25	6.21	5.99				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kawainui mauka (station No. 44), Waipio River drainage basin, Hawaii, 1907–1911.

[Elevation, 4,080 feet.]

Month.	1907	1908	1909	1910	1911	Average, 4 years.	Maximum.	Minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January		13.70	14.90	40.94	28.38	24.48	40.94	13.70
February		12.03	21.42	29.38	32.38	23.80	32.38	12.03
March		3.35	26.45	30.75	16.59	19.28	30.75	3.35
April		26.57	4.48	24.25	16.69	18.00	26.57	4.48
May		32.58	13.85	34.38	34.31	28.78	34.38	13.85
June		31.60	10.60	46.49	53.34	35.51	53.34	10.60
July	37.86	40.74	25.14	34.71	25.67	32.82	40.74	25.14
August	59.42	24.61	9.00	27.54	33.90	30.89	59.42	9.00
September	40.29	19.20	14.52	7.71	40.52	24.45	40.52	7.71
October	20.58	11.66	12.52	21.01	31.84	19.52	31.84	11.66
November	12.88	19.10	12.16	23.51	26.04	18.74	26.04	12.16
December	12.63	18.75	22.83	25.16	23.45	20.56	25.16	12.63
Annual	183.66	253.89	187.87	345.83	363.11	266.87	363.11	187.87
Mean daily	[a] 1.00	.69	.51	.94	.99	.73	.99	.51

[a] For 6 months.

NOTE.—Readings made daily. Records furnished by Hawaiian Irrigation Co. (Ltd.), Kukuihaele, Hawaii.

Rainfall at lower Kawainui (station No. 45), Waipio River drainage basin, Hawaii, 1910–11.

[Elevation, 1,040 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January		16.68	September	1.64	15.98
February		47.97	October	7.01	7.65
March		8.95	November	14.23	8.14
April		20.06	December	13.03	10.82
May		16.85			
June		24.32	Annual		204.98
July		12.52	Mean daily	[a] .29	.56
August		15.01			

[a] For 4 months.

NOTE.—Readings made daily. Records furnished by Hawaiian Irrigation Co. (Ltd.), Kukuihaele, Hawaii.

Rainfall at Alakahi (station No. 46), Waipio River drainage basin, Hawaii, 1910–11.

[Elevation, 1,030 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January		13.87	September	1.53	10.42
February		35.86	October	6.74	5.33
March		9.95	November	7.86	5.69
April		13.29	December	10.21	8.51
May		11.33			
June		16.44	Annual		148.44
July		7.90	Mean daily	[a] .21	.41
August		9.85			

[a] For 4 months.

NOTE.—Readings made daily. Records furnished by Hawaiian Irrigation Co. (Ltd.), Kukuihaele, Hawaii.

Rainfall at Koiawe (station No. 47), Waipio River drainage basin, Hawaii, 1910–11.

[Elevation, 1,000 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	11.65	September	1.54	9.66
February	.....	20.43	October	6.50	4.51
March	.....	7.36	November	7.60	5.02
April	.....	10.54	December	10.00	7.56
May	.....	10.93			
June	.....	17.26	Annual	.....	123.11
July	.....	8.24	Mean daily	[a].21	.34
August	.....	9.95			

[a] For 4 months.

NOTE.—Readings made daily. Records furnished by the Hawaiian Irrigation Co. (Ltd.), Kukuihaele, Hawaii.

Rainfall at Waimea (station No. 48), Hawaii, 1910–11.

[Elevation, 2,720 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	9.41	8.74	4.72	September	2.17	3.35	2.12
February	4.39	15.15	4.83	October	4.70	1.40	2.67
March	3.03	5.03	5.16	November	2.52	1.89	3.17
April	4.01	4.45	3.50	December	3.48	2.44	5.13
May	2.34	4.20	2.71				
June	4.27	5.23	2.22	Annual	45.17	57.22	42.40
July	2.90	2.37	2.82	Mean daily	.124	.157	.116
August	1.95	2.97	3.35				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Awini (station No. 49), Awini Stream drainage basin, Hawaii, 1910–11.

[Elevation, 2,100 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	17.16	21.86	September	4.72	19.99
February	18.60	35.72	October	13.00	6.19
March	16.09	12.74	November	16.29	12.06
April	15.24	17.48	December	25.25	8.67
May	15.85	16.45			
June	21.52	24.73	Annual	197.04	203.24
July	18.32	12.17	Mean daily	.540	.557
August	15.00	15.18			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Honokane (station No. 50), Honokane Stream drainage basin, Hawaii, 1910–11.

[Elevation, 1,042 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	22.03	18.72	September	2.39	16.54
February	15.17	51.64	October	10.73	4.10
March	17.64	11.03	November	15.19	13.01
April	19.25	19.01	December	16.82	12.07
May	17.36	15.85			
June	17.50	21.79	Annual	182.60	208.70
July	16.21	10.02	Mean daily	.500	.572
August	12.31	14.92			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Niulii (station No. 51), Hawaii, 1910–11.

[Elevation, 200 feet.]

Month.	1910	1911	Average, 26 years.	Month.	1910	1911	Average, 26 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	7.91	8.00	4.39	September	1.91	8.23	3.90
February	2.65	8.72	4.62	October	4.38	3.17	3.61
March	7.82	7.44	6.19	November	4.87	6.55	4.97
April	5.85	7.89	5.57	December	11.89	2.22	5.11
May	4.35	3.79	4.44				
June	5.41	8.56	3.18	Annual	71.25	73.31	55.62
July	8.95	3.83	4.88	Mean daily	.195	.201	.152
August	5.26	4.91	4.76				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kohala (Maulili) (station No. 52), Hawaii, 1910–11.

[Elevation, 960 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	6.72	8.28	September	1.82	6.50
February	3.52	9.71	October	5.94	3.51
March	5.40	5.49	November	5.80	4.79
April	5.40	8.77	December	11.38	2.27
May	4.57	4.62			
June	7.60	7.95	Annual	70.91	71.08
July	6.81	4.07	Mean daily	.194	.195
August	5.95	5.12			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kohala mission (station No. 53), Hawaii, 1910–11.

[Elevation, 520 feet.]

Month	1910	1911	Average, 22 years.	Month.	1910	1911	Average, 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.27	7.92	5.02	September	2.06	4.62	3.42
February	2.44	8.18	5.42	October	4.16	2.72	3.70
March	6.49	6.42	7.12	November	5.11	4.72	4.94
April	4.95	7.90	5.87	December	9.93	1.83	5.15
May	4.56	2.93	4.01				
June	5.48	6.94	3.38	Annual	63.11	60.91	57.68
July	6.53	3.14	4.80	Mean daily	.173	.167	.158
August	5.13	3.59	4.85				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kohala mill (station No. 54), Hawaii, 1910–11.

[Elevation, 270 feet.]

Month.	1910	1911	Average, 16 years.	Month.	1910	1911	Average, 16 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.55	7.98	3.82	September	1.69	6.68	3.78
February	2.13	8.03	5.02	October	4.18	2.59	3.67
March	6.84	7.21	6.70	November	4.51	5.57	5.05
April	4.93	6.96	5.62	December	9.13	2.27	5.16
May	4.28	3.57	4.14				
June	5.42	8.07	3.23	Annual	61.79	66.95	55.64
July	7.25	3.70	4.87	Mean daily	.169	.183	.152
August	4.88	4.32	4.58				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hawi mill (station No. 55) Hawaii, 1910–11.

[Elevation, 600 feet.]

Month.	1910	1911	Average, 12 years.	Month.	1910	1911	Average, 12 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	7.33	8.16	4.11	September	1.60	4.93	3.59
February	2.62	8.24	6.13	October	4.70	3.14	3.84
March	6.74	4.74	7.22	November	4.71	5.46	5.01
April	4.88	7.15	6.80	December	8.79	2.76	6.01
May	3.79	3.27	4.43				
June	6.00	7.75	3.64	Annual	62.70	63.82	60.56
July	6.54	3.83	5.20	Mean daily	.172	.175	.166
August	5.00	4.34	4.58				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Puakea ranch (station No. 56) Hawaii, 1910–11.

[Elevation, 600 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	8.40	5.59	September	1.01	3.31
February	1.46	6.74	October	3.20	.57
March	5.28	5.86	November	.....	4.16
April	3.98	4.52	December	8.44	1.81
May	3.42	2.02			
June	4.85	5.81	Annual	.....	45.82
July	5.23	2.44	Mean daily	a.146	.126
August	3.74	2.99			

a For 11 months.

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Puuwaawaa (station No. 57), Hawaii, 1910–11.

[Elevation, 2,740 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	2.77	4.81	September	1.93	2.04
February	4.74	1.74	October	1.86	.00
March	.28	5.76	November	.54	.62
April	.19	4.05	December	.95	1.46
May	.57	4.23			
June	1.65	.45	Annual	23.55	27.91
July	5.86	1.03	Mean daily	.064	.076
August	2.21	1.72			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Huehue (station No. 58), Hawaii, 1910–11.

[Elevation, 2,000 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	4.27	5.90	September	9.43	4.17
February	.83	2.17	October	1.43	1.15
March	.64	5.61	November	.85	1.39
April	.72	3.44	December	1.18	1.38
May	.54	1.63			
June	3.01	1.00	Annual	25.80	31.90
July	1.93	1.36	Mean daily	.071	.087
August	.97	2.70			

NOTE.—Compiled from U. S. Weather Bureau records.

74323°—WSP 318—13——31

Rainfall at Holualoa (station No. 59), Hawaii, 1910–11.

[Elevation, 1,350 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	3.15	6.73	3.35	September	15.65	7.45	7.79
February	2.45	.96	3.69	October	6.45	6.54	5.00
March	3.68	6.91	4.74	November	.51	3.91	3.19
April	1.87	2.29	4.38	December	.72	2.45	3.27
May	2.76	5.44	5.63				
June	7.55	7.01	5.66	Annual	59.15	61.56	61.59
July	8.45	4.48	7.16	Mean daily	.162	.169	.169
August	5.91	7.39	7.73				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kealakekua (station No. 60), Hawaii, 1910–11.

[Elevation, 1,580 feet.]

Month.	1910	1911	Average, 21 years.	Month.	1910	1911	Average, 21 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	6.43	7.03	3.79	September	13.59	8.79	8.09
February	.79	1.55	4.06	October	6.68	7.10	6.40
March	1.94	7.07	4.17	November	.51	4.60	4.08
April	2.62	2.58	4.92	December	.47	2.93	3.00
May	1.96	5.81	6.47				
June	6.98	9.75	6.51	Annual	53.10	73.44	67.30
July	6.83	6.07	7.76	Mean daily	.145	.201	.184
August	4.30	10.16	8.05				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Napoopoo (station No. 61), Hawaii, 1910–11.

[Elevation, 25 feet.]

Month.	1910	1911	Average, 10 years.	Month.	1910	1911	Average, 10 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	5.00	3.55	2.33	September	3.68	3.94	4.02
February	.00	1.50	2.21	October	1.90	3.50	2.24
March	.00	6.04	2.53	November	.10	2.15	1.47
April	.00	2.31	2.40	December	.85	2.55	2.75
May	.10	1.82	4.32				
June	1.90	3.37	3.13	Annual	18.59	36.76	34.30
July	2.68	1.98	2.77	Mean daily	.051	.101	.094
August	2.38	4.05	4.13				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hoopuloa (station No. 62), Hawaii, 1910–11.

[Elevation, 2,425 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	2.48	7.61	September	4.57	7.30
February	.49	1.87	October	2.58	3.76
March	3.40	7.60	November	.87	1.31
April	3.33	3.73	December	1.11	1.70
May	2.83	6.00			
June	2.65	7.83	Annual	35.19	57.51
July	6.26	3.67	Mean daily	.096	.158
August	4.62	5.22			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kau (station No. 63), Hawaii, 1910–11.

[Elevation, 1,850 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	3.00	7.16	September	5.72	6.16
February	1.31	13.55	October	*3.99	5.67
March	2.96	11.00	November	4.00	4.07
April	2.72	6.25	December	4.30	3.35
May	1.95	5.71			
June	5.12	5.9	Annual	47.41	81.81
July	4.66	7.22	Mean daily	.130	.224
August	7.68	5.77			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Naalehu (station No. 64), Hawaii, 1910–11.

[Elevation, 650 feet.]

Month.	1910	1911	Average 22 years.	Month.	1910	1911	Average 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	7.01	4.98	5.04	September	3.46	1.36	3.10
February	1.31	8.85	5.00	October	1.84	3.84	3.35
March	2.74	11.85	5.61	November	3.32	2.60	4.97
April	1.39	4.53	3.05	December	1.69	4.35	3.80
May	.70	2.22	1.90				
June	1.49	1.44	1.26	Annual	33.80	49.62	42.94
July	1.21	1.66	1.92	Mean daily	.093	.136	.113
August	7.64	1.94	3.94				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Hilea (station No. 65), Hawaii, 1910–11.

[Elevation, 310 feet.]

Month.	1910	1911	Average 22 years.	Month.	1910	1911	Average 22 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.59	3.64	2.34	September	2.40	3.46	2.26
February	1.93	8.50	3.97	October	.94	1.47	2.58
March	2.39	12.17	4.86	November	3.28	.53	4.64
April	.77	3.27	2.76	December	2.30	3.65	3.59
May	.56	2.75	1.37				
June	.91	.63	.74	Annual	29.46	42.85	33.63
July	.58	1.19	1.46	Mean daily	.081	.117	.092
August	8.81	1.59	3.06				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Pahala (station No. 66), Hawaii, 1910–11.

[Elevation, 850 feet.]

Month.	1910	1911	Average 20 years.	Month.	1910	1911	Average 20 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	5.02	2.64	3.89	September	2.92	2.16	2.39
February	3.98	9.11	5.35	October	.94	3.88	2.72
March	.51	11.83	5.53	November	2.74	.45	5.45
April	.29	5.34	2.37	December	2.19	3.25	3.38
May	.62	2.71	1.70				
June	.63	.10	.74	Annual	26.26	44.38	8.073
July	.56	.78	.89	Mean daily	.072	.121	.104
August	5.86	2.13	3.66				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kapapala ranch (station No. 67), Hawaii, 1910–11.

[Elevation, 2,150 feet.]

Month.	1910	1911	Average, 26 years.	Month.	1910	1911	Average, 26 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	4.99	6.99	5.63	September	4.19	6.80	3.75
February	5.65	7.60	6.68	October	2.17	3.08	4.33
March	.92	17.21	7.64	November	3.38	1.38	6.81
April	.98	6.92	3.62	December	3.33	2.81	4.77
May	2.74	4.93	3.19				
June	1.60	.00	1.28	Annual	37.91	62.00	53.28
July	2.53	1.78	2.03	Mean daily	.104	.170	.146
August	5.43	2.50	3.55				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Volcano House (station No. 68), Hawaii, 1910–11.

[Elevation, 3,970 feet.]

Month.	1910	1911	Average, 13 years.	Month.	1910	1911	Average, 13 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	12.92	8.50	6.30	September	2.67	8.15	4.70
February	1.66	24.58	8.55	October	3.69	4.71	5.77
March	9.50	10.01	9.72	November	6.17	8.09	8.42
April	7.18	10.44	7.45	December	6.29	9.59	6.48
May	8.34	1.39	5.52				
June	6.50	4.52	3.34	Annual	77.77	92.33	78.71
July	3.45	.00	4.60	Mean daily	.213	.253	.216
August	9.40	2.35	7.86				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Mountain View (station No. 69), Hawaii, 1910–11.

[Elevation, 1,530 feet.]

Month.	1910	1911	Average, 11 years.	Month.	1910	1911	Average, 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	26.45	17.56	14.10	September	8.03	22.06	16.64
February	6.96	45.10	14.44	October	15.09	14.65	13.42
March	22.80	15.71	19.36	November	18.14	23.25	21.19
April	20.80	28.39	19.33	December	16.62	22.12	16.52
May	19.75	26.31	15.85				
June	21.49	21.00	10.58	Annual	218.72	266.45	201.26
July	17.73	12.29	17.00	Mean daily	.599	.730	.552
August	24.86	18.01	22.83				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kurtistown (station No. 70), Hawaii, 1910–11.

[Elevation, 640 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	19.11	16.15	September	5.22	18.82
February	3.44	33.41	October	7.21	3.68
March	13.50	19.25	November	13.40	15.67
April	10.31	21.12	December	18.95	19.92
May	10.23	22.16			
June	8.11	16.16	Annual	147.96	206.73
July	21.99	7.43	Mean daily	.405	.566
August	16.46	12.96			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Olaa mill (station No. 71), Hawaii, 1910–11.

[Elevation, 210 feet.]

Month.	1910	1911	Average, 11 years.	Month.	1910	1911	Average, 11 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	20.08	13.73	10.08	September	5.41	14.29	12.85
February	5.47	19.07	10.88	October	8.00	7.23	10.94
March	12.34	13.15	15.83	November	10.89	13.82	15.61
April	9.71	19.75	13.88	December	17.92	15.06	13.89
May	11.36	21.98	10.03				
June	8.91	11.28	7.72	Annual	135.27	166.10	147.66
July	10.81	7.07	11.98	Mean daily	.370	.455	.405
August	14.37	9.67	13.97				

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Pahoa (station No. 72), Hawaii, 1910–11.

[Elevation, 700 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	29.44	16.13	September	8.85	12.84
February	7.18	42.39	October	10.49	3.86
March	10.96	20.14	November	12.23	14.34
April	7.84	19.01	December	19.10	21.64
May	10.28	22.60			
June	18.00	21.80	Annual	154.98	214.15
July	11.07	17.97	Mean daily	.425	.586
August	9.54	1.43			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kaueleau (station No. 73), Hawaii, 1910–11.

[Elevation, 1,000 feet.]

Month.	1910	1911	Month.	1910	1911
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	33.70	16.39	September	7.89	16.91
February	3.95	38.52	October	9.89	9.30
March	12.14	27.30	November	12.22	14.39
April	9.30	15.60	December	14.83	19.39
May	12.93	18.84			
June	11.55	14.81	Annual	152.35	208.25
July	12.56	7.09	Mean daily	.417	.570
August	11.39	9.71			

NOTE.—Compiled from U. S. Weather Bureau records.

Rainfall at Kapoho (station No. 74), Hawaii, 1910–11.

[Elevation, 110 feet.]

Month.	1910	1911	Average, 20 years.	Month.	1910	1911	Average, 20 years.
	Inches.	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
January	21.42	9.39	8.67	September	6.99	10.80	7.44
February	4.19	15.39	8.79	October	6.34	3.33	7.55
March	5.25	13.18	11.06	November	6.31	8.23	7.98
April	3.89	12.10	6.33	December	15.46	10.92	7.94
May	6.21	11.44	5.42				
June	5.90	8.28	4.98	Annual	94.96	112.05	88.54
July	6.76	4.08	5.34	Mean daily	.260	.307	.242
August	6.24	4.91	7.04				

NOTE.—Compiled from U. S. Weather Bureau records.

Alphabetic list of rainfall stations on Island of Hawaii.

Name.	No.	Elevation.	Name.	No.	Elevation.
		Feet.			*Feet.*
Alakahi	46	1,030	Laupahoehoe	27	100
Awini	49	2,100	Mauna Kea, east slope	9	5,000
Coffee plantation	33	1,600	Do	10	4,500
Hakalau	22	200	Do	11	4,000
Hakalau mauka	21	1,200	Do	12	3,500
Hapea	31	4,000	Do	13	3,000
Hapea mauka	30	5,000	Do	14	2,500
Hawi mill	55	600	Do	15	2,000
Hilea	65	310	Do	16	1,500
Hilo	6	100	Do	17	1,000
Hilo breakwater	8	15	Do	18	500
Holualoa	59	1,350	Mountain View	69	1,530
Honohina	23	300	Naalehu [a]	64	650
Honokaa	41	470	Napoopoo	61	25
Honokaa mauka	40	1,100	Niulii	51	200
Honokane	50	1,042	Olaa mill	71	210
Hoopuloa	62	2,425	Ookala	28	400
Huehue	58	2,000	Paauhau	39	1,150
Humuula	1	6,685	Paauilo	37	30
Kalopa	38	900	Paauilo mauka	36	300
Kapapala ranch	67	2,150	Pahala	66	850
Kapoho	74	110	Pahoa	72	700
Kau	63	1,850	Papaaloa	26	260
Kaueleau	73	1,000	Papaikou	19	250
Kawainui	45	1,040	Paukea ranch	56	600
Kawainui mauka	44	4,080	Pepeekeo	20	100
Kealakekua	60	1,580	Piihonua	4	1,000
Keanakolu	25	5,500	Piihonua mauka	3	1,900
Kohala (Maulili)	52	960	Ponahawai	5	500
Kohala mill	54	270	Puu Kihe	29	7,850
Kohala mission	53	520	Puu Oo	2	6,450
Koiawe	47	1,000	Puuwaawaa	57	2,740
Kukaiau mill	35	250	Umikoa ranch	32	3,400
Kukaiau office	34	800	Volcano House	68	3,970
Kukuihaele	43	700	Waiakea mill	7	50
Kukuihaele (Hawaiian Irrigation Co. weir)	42	930	Waikaumalo	24	275
Kurtistown	70	640	Waimea	48	2,720

[a] Evaporation station.

EVAPORATION FROM WATER SURFACE.

The action of evaporation is so gradual and continuous from day to day that its effect on the storage of water is likely to be overlooked unless special attention is called to it and figures given to show the total loss per month or year. This loss becomes an item of importance when large quantities of water are held in storage over a considerable period of time, as in the case of reservoirs for municipal supply or for irrigation systems depending on storm flow. The effect of evaporation must also be taken into account in estimating probable run-off from drainage areas by means of rainfall records.

Data regarding evaporation must necessarily be limited to observations made on small quantities of water confined in specially prepared receptacles, except in those rare instances where the total inflow and outflow of a natural pond or lake can be accurately measured. It is, of course, impossible to secure in the evaporation pan all the conditions that affect evaporation from a large body of water whose surface, roughened by the wind, gives a larger area constantly exposed to shifting air currents. For this reason the actual losses by evapo-

ration are probably somewhat greater than those shown by the evaporation pan.

Evaporation records were obtained during 1910 and 1911 at nine stations on the islands of Kauai, Oahu, and Hawaii. Records of evaporation under roof cover were also obtained at two stations on Oahu. The gage used in measuring evaporation consisted of a circular galvanized-iron pan, 10 inches deep and about 18 inches in diameter. Readings were made from the surface of the water to the top of a sharp point extending about 2 inches above the bottom in the center of the pan. The pan was filled with water to about 3 inches from the top, water being added or taken out from time to time, depending on the amount of evaporation and the rainfall. Rainfall records were obtained at the stations, and the amount of rainfall was taken into account in measuring the evaporation. Owing to the small size of the pan and the necessity of keeping the water surface some distance below the top, the effect of the wind in aiding evaporation was probably modified to a large extent. Despite the precaution of keeping the water low, the pan was likely to overflow at times of heavy rainfall. At such times, even if no overflow occurred, there were often considerable losses of water by spattering out over the sides of the pan, which probably accounts for the extremely large evaporation shown at times of heavy rainfall.

Owing to the difficulties in obtaining evaporation records, the data here presented are not considered as having throughout a high degree of accuracy. They give, however, some general information on a subject not heretofore investigated in the Territory of Hawaii.

Evaporation at Waiakoali camp, Kauai, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.	Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*	1910.	*Days.*	*Inches.*	*Inches.*
May 15 [a]				June 16	7	0.50	0.071
July 10	56	2.83	0.051	23	7	.80	.114
Aug. 23	44	2.27	.052	30	7	.40	.057
Sept. 16	24	1.05	.044	July 7	7	.70	.100
Oct. 8 [b]				14	7	.50	.071
16	8	.40	.050	21	7	.60	.086
1911.				28	7	.60	.086
Feb. 25 [c]				Aug. 18	21	1.70	.081
Mar. 11	14	1.50	.107	25	7	.70	.100
17	6	1.70	.283	Sept. 1	7	.60	.086
25	8	.90	.112	9	8	.60	.086
Apr. 1	7	2.60	.371	15	6	.32	.053
7	6	.75	.125	22	7	.28	.040
14	7	.10	.014	29	7	.40	.057
23	9	.30	.033	Oct. 13	14	.80	.057
29 [b]				Nov. 12	30	.62	.021
May 5	6	.80	.133	Dec. 27 [b]			
12	7	.50	.071				
19	7	.60	.086				
26							
June 2							
9	7	.10	.014				

[a] Station established. [b] Pan overflowed. [c] Station reestablished.

Evaporation at Puu Lua, Kauai, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*
Sept. 24[a]			
Oct. 8	14	1.44	0.103
15	7	.89	.127
1911.			
Feb. 25[b]			
Mar. 11	14	2.10	.150
18	7	2.40	.343
25	7	.90	.129
Apr. 1	7	3.00	.429
8	7	.50	.071
15	7	.50	.071
23	8	.90	.112
29	6	.85	.142
May 6	7	.55	.079
12	6	.70	.117
19	7	.90	.129
26	7	1.00	0.143
June 2	7	1.20	.171
9[c]			
16	7	1.15	.164
30	14	2.55	.182
July 28	28	5.70	.204
Aug. 18	21	2.65	.126
25	7	1.00	.143
Sept. 15	21	3.50	.167
22	7	1.10	.157
29	7	1.00	.143
Oct. 14	15	1.90	.127
Nov. 11	28	2.74	.098
Dec. 28	47	4.20	.089
Feb. 25 to Dec. 28, 1911[c]	299	41.99	.140

[a] Station established. [b] Station reestablished. [c] No record for week ending June 9.

Evaporation at Waiawa, Kauai, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*
June 10[a]			
July 5	25	4.78	0.191
Aug. 5	31	5.32	.171
31	26	5.72	.220
Oct. 8	38	5.68	.150
15	7	1.08	.154
22	7	.85	.121
29	7	.69	.099
Nov. 21	23	.50	.022
Dec. 15	24	1.30	.054
26	11	1.14	.104
June 10 to Dec. 26, 1910	199	27.06	.136
1911.			
Jan. 8	13	.20	.015
16	8	.70	.088
17[b]			
24	7	.42	.060
31	7	.65	.093
Feb. 7	7	.38	.054
12	5	.73	.146
20	8	.80	.100
27	7	1.06	.151
Mar. 6	7	.86	.123
12	6	.52	.087
20	8	.85	.106
26	6	.70	.117
Apr. 2	7	1.25	.179
10	8	1.40	.175
17	7	.76	.109
24	7	1.20	.171
30	6	1.02	.170
May 7	7	1.40	.200
14	7	1.10	.157
21	7	1.58	.226
28	7	1.58	0.226
June 4	7	1.29	.184
11	7	1.50	.214
18	7	1.70	.243
25	7	1.52	.217
July 2	7	1.10	.157
9	7	1.90	.271
16	7	1.50	.214
23	7	1.50	.214
28	5	.85	.170
31	3	.60	.200
Aug. 7	7	1.60	.229
14	7	.80	.114
20	6	.48	.080
27	7	1.80	.257
Sept. 4	8	1.40	.175
17	13	2.42	.186
24	7	.85	.121
Oct. 1	7	.70	.100
8	7	1.10	.157
15	7	.70	.100
22	7	.75	.107
29	7	1.04	.149
Nov. 4	6	1.00	.167
13	9	1.10	.122
19	6	.60	.100
26	7	.80	.114
Dec. 3	7	.60	.086
10	7	.86	.123
17	7	.85	.121
24	7	.82	.117
31	7	.52	.074
Dec. 26, 1910, to Dec. 31, 1911[b]	369	53.41	.145

[a] Station established. [b] No record on Jan. 17.

Evaporation at Koloa, Kauai, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*
Sept. 6 [a]			
13	7	0.98	0.140
20	7	.87	.124
27	7	1.27	.181
Oct. 4	7	1.47	.210
11	7	1.12	.160
18	7	.89	.127
25	7	.86	.123
Nov. 1	7	.75	.107
2 [b]			
9	7	.81	.116
16	7	.91	.130
23	7	.93	.133
30	7	.60	.086
Dec. 7	7	.88	.126
14	7	.60	.086
21	7	.60	.086
28	7	.71	.101
Sept. 6 to Dec. 28, 1910 [c]	112	14.25	.127
1911.			
Jan. 4	7	.89	.127
11	7	.39	.056
18	7	.60	.086
25	7	.47	.067
Feb. 1	7	.35	050
8	7	.87	.124
15	7	.75	.107
22	7	.73	.104
Mar. 1	7	1.03	.147
8	7	.70	.100
15	7	.96	.137
22	7	1.10	.157
29	7	1.00	.143
Apr. 5	7	1.50	.214
12	7	.92	.131
19	7	.91	.130
26	7	.99	.141
May 3	7	1.44	0.206
10	7	1.22	.174
17	7	1.01	.144
24	7	.91	.130
31	7	1.26	.180
June 7	7	1.08	.154
14	7	1.40	.200
21	7	1.22	.174
28	7	.98	.140
July 5	7	1.26	.180
12	7	1.16	.166
19	7	.94	.134
26	7	1.19	.170
Aug. 2	7	1.20	.171
9	7	1.35	.193
16	7	1.04	.149
23	7	1.23	.176
30	7	1.23	.176
Sept. 6	7	1.09	.156
13	7	.94	.134
20	7	1.02	.146
27	7	.79	.113
Oct. 4	7	.94	.134
11	7	1.13	.161
18	7	.80	.114
25	7	.74	.106
Nov. 1	7	.91	.130
8	7	1.07	.153
15	7	.74	.106
22	7	.92	.131
29	7	.70	.100
Dec. 6	7	.54	.077
13	7	.79	.113
20	7	.79	.113
27	7	.57	.081
Dec. 28, 1910, to Dec. 27, 1911	364	49.76	.137

[a] Station established. [b] Pan overflowed. [c] No record on Nov. 2.

Evaporation at Kealia, Kauai, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*
Sept. 3 [a]			
12	9	1.74	0.193
Oct. 15	33	7.64	.232
28 [b]			
Dec. 17	50	14.66	.293
1911.			
Jan. 9	23	4.46	.194
May 4	115	19.63	.171
27	23	4.86	.211
June 3	7	1.53	0.219
27	24	5.32	.222
July 13	16	3.81	.238
21	8	1.83	.229
Aug. 12	22	5.67	.258
Sept. 2	21	5.06	.241
Jan. 9 to Sept. 2, 1911	259	52.17	.201

[a] Station established. [b] Pan overflowed.

Evaporation at Spencer Street, Honolulu, Oahu, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.	Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*	1911.	*Days.*	*Inches.*	*Inches.*
June 17 [a]				Feb. 22	9	1.12	0.12
21	4	0.49	0.122	26 [b]			
30	9	.45	.050	Mar. 11	13	.97	.07
July 19	19	3.57	.188	21	10	1.09	.10
Aug. 27	39	5.99	.154	30	9	.68	.07
Sept. 20	24	2.92	.122	Apr. 13	14	1.93	.13
26	6	.74	.123	20	7	1.16	.16
Oct. 3	7	.90	.129	28	8	.77	.09
11	8	1.13	.141	May 5	7	.63	.09
20	9	1.56	.173	17	12	1.94	.16
26	6	1.10	.183	25	8	1.49	.18
31	5	.43	.086	June 2	8	.53	.06
Nov. 2	2	.28	.140	13	11	2.08	.18
10	8	1.03	.129	21	8	1.86	.23
16	6	.99	.165	July 1	10	1.82	.18
24	8	1.17	.146	9	8	1.50	.18
Dec. 7	13	1.84	.142	15	6	1.41	.23
20	13	2.02	.155	22	7	1.59	.22
29	9	.71	.079	30	8	1.07	.13
31	2	.45	.225	Aug. 5	6	1.27	.21
				14	9	1.99	.22
June 17 to Dec. 31, 1910	197	27.77	.141	19	5	.94	.18
				Sept. 2	14	1.79	.12
1911.				16	14	2.16	.15
Jan. 12	12	1.73	.144	23	7	.98	.14
25	13	1.26	.097	30	7	.95	.13
Feb. 1	7	1.29	.184				
6 [b]				Dec. 31, 1910 to Sept. 30, 1911 [c]	264	38.45	.14
13	7	.45	.064				

[a] Station established. [b] Pan overflowed. [c] No records for Feb. 1–6 and 22–26.

Evaporation at Hoaeae, Oahu, 1911.

Month.	Total for period.	Average daily.
	Inches.	*Inches.*
September	9.48	0.31
October	7.32	.23
November	6.77	.22
December	5.51	.17
September 1 to December 31	29.08	.23

Evaporation at upper Luakaha, Oahu, 1910–11.

Month.	Total for period.	Average daily.
1910.	*Inches.*	*Inches.*
October 1–4 and 12–31	5.48	0.228
November	5.45	.182
December	3.23	.104
The period (85 days)	14.16	.167
1911.		
January	[a] 7.08	[a] .228
February	[a] 8.50	[a] .304
March	3.54	.114
April	3.54	.118
May 1–21 and 28–31	[a] 7.35	[a] .294
June 1–9 and 15–30	5.39	.216
July	6.13	.198
August	5.82	.188
September	[a] 13.08	[a] .436
October	3.09	.100
November	3.72	.124
December	2.97	.096
The period (354 days)	[a] 70.21	[a] .198

[a] Figures probably too large, due to loss of water by spattering from pan at times of heavy rainfall.

Evaporation under roof cover of Punchbowl reservoir, Honolulu, Oahu, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*
Oct. 5 [a]			
18	13	0.46	0.035
29	11	.31	.028
1911.			
Feb. 2	96	2.28	.024
Oct. 5, 1910, to Feb. 2, 1911	120	3.05	.025

[a] Station established.

Evaporation in basement of Executive Building, Honolulu, Oahu, 1910–11.

Date of observation.	Period.	Total for period.	Average daily.
1910.	*Days.*	*Inches.*	*Inches.*
Oct. 6 [a]			
15	9	0.35	0.039
26	11	.35	.032
Nov. 29	34	1.02	.030
1911.			
Feb. 2	65	1.80	.028
May 9	96	2.50	.026
Sept. 11	125	3.75	.030
Oct. 6, 1910, to Sept. 11, 1911	340	9.77	.029

[a] Station established.

Evaporation at Naalehu, Hawaii, 1911.

Month.	Total for period.	Average daily.
	Inches.	*Inches.*
July 2–31	6.36	0.212
August	7.24	.234
September	7.96	.265
October 5–31	8.29	.307
November	7.50	.250
December 1–25	6.86	.274
The period (173 days)	44.21	.256

TEMPERATURE.

Although located within the Torrid Zone, between 18° 55′ and 22° 15′ north latitude, the climate of the Hawaiian Islands can hardly be said to be tropical. At the most it is only subtropical, and probably the word "temperate" applies better to it than to the climate of most places north of the Tropic of Cancer. This is due largely to the northeast trade winds and to the cold currents from the north Pacific, which cool the ocean about the islands, giving them a temperature 10° lower than that of any other part of the world of the same latitude.[1] The temperature at sea level averages about 75° F. through-

[1] See Bishop, S. E., Cold current system of the Pacific: Hawaiian Annual, 1905, p. 74.

out the year, the warmest period being from May to September, when a temperature of 90° may be reached. The temperature at sea level seldom goes below 55°, but at higher elevations it falls lower, freezing temperature being reached on the summits of the highest mountains.

Snow is seldom if ever seen on the islands of Kauai and Oahu. Thunderstorms usually bring snow to Haleakala, on Maui, but these are of rare occurrence. Mauna Kea, Mauna Loa, and Hualalai, on Hawaii, are usually crowned with snow during the winter, and snow was visible on the summit of Mauna Kea throughout the summer of 1911.

The United States Weather Bureau has obtained records of temperature at a number of its climatologic stations on the different islands. From these records the mean, maximum, and minimum temperatures have been compiled for each month during 1911 for a few stations which, although at low elevations, are representative of average conditions on the inhabited parts of the islands.

Temperature (°F.) at stations on Hawaiian Islands, 1911.

[Compiled from United States Weather Bureau records.]

Mana Pump, Kauai.

[Elevation, 30 feet.]

Month.	Mean.	Highest.	Lowest.	Greatest daily range.	Month.	Mean.	Highest.	Lowest.	Greatest daily range.
January	69.2	83	56	22	August [b]	78.4	92	64	24
February [a]	70.7	84	57	26	September [c]	78.2	92	65	25
March	71.4	88	56	25	October [d]	75.2	90	63	23
April	73.2	87	58	25	November [d]	73.0	88	60	24
May	73.9	87	60	25	December	70.2	84	56	25
June	76.0	89	62	25					
July	76.4	90	63	25	The year	73.8	92	56	26

Makaweli, Kauai.

[Elevation, 140 feet.]

January	70.2	81	56	24	August	78.2	88	68	19
February	70.2	82	57	23	September	76.8	88	64	18
March	71.2	83	55	22	October	75.6	86	61	22
April	73.0	86	55	27	November	75.0	86	61	20
May	73.4	85	63	21	December	73.0	86	60	26
June	75.2	86	64	19					
July	75.2	85	63	20	The year	73.9	88	55	27

Lihue, Kauai.

[Elevation, 200 feet.]

January	68.4	78	52	22	August	77.4	88	66	18
February [e]	67.6	79	54	22	September	76.2	85	66	16
March	69.2	81	53	25	October	74.6	83	58	25
April	71.3	84	51	27	November	72.8	83	57	22
May	72.4	82	61	20	December	70.8	81	52	27
June	75.1	84	65	17					
July	76.2	86	64	22	The year	72.6	88	51	27

[a] Records for 3 days missing.
[b] Records for 2 days missing.
[c] Records for 4 days missing.
[d] Records for 1 day missing.
[e] Records for 7 days missing.

Temperature (°F.) at stations on Hawaiian Islands, 1911—Continued.

Kilauea, Kauai.

[Elevation, 342 feet.]

Month.	Mean.	Highest.	Lowest.	Greatest daily range.	Month.	Mean.	Highest.	Lowest.	Greatest daily range.
January	68.2	77	57	20	August	76.6	88	66	18
February	68.4	82	55	24	September	74.9	85	64	16
March	69.6	81	57	22	October	73.9	85	60	23
April	71.6	84	53	22	November	72.5	85	60	22
May	72.6	82	61	18	December	70.4	80	57	18
June	74.3	82	65	15					
July	75.1	84	65	17	The year	72.3	88	53	24

Waianae, Oahu.

[Elevation, 6 feet.]

January	71.3	83	59	21	August	80.0	91	65	22
February	70.4	82	55	26	September [a]	79.3	90	68	20
March	71.9	85	52	26	October	75.5	88	63	24
April	73.8	86	52	25	November [a]	74.8	86	58	25
May	74.8	87	62	22	December	73.2	86	57	29
June	77.3	89	65	23					
July	79.2	90	65	25	The year	75.1	91	52	29

Honolulu, Oahu.

[Elevation, 111 feet.]

January	70.0	79	58	15	August	78.1	85	70	13
February	69.8	78	62	14	September	76.8	85	69	13
March	71.4	80	63	15	October	75.2	84	67	13
April	73.3	82	61	16	November	74.7	83	66	14
May	74.3	84	64	15	December	72.4	81	64	14
June	75.3	82	66	12					
July	76.4	84	68	13	The year	74.0	85	58	16

Schofield Barracks, Oahu.

[Elevation, 990 feet.]

January	66.6	80	55	18	August	74.0	86	62	23
February	65.8	78	54	24	September	73.2	85	62	22
March	67.4	79	52	22	October	71.2	87	57	26
April	68.9	80	51	23	November	66.4	81	56	20
May	69.8	81	57	20	December	68.1	79	54	24
June	71.0	81	60	20					
July	73.0	89	61	27	The year	69.6	89	51	27

Tantalus, Oahu.

[Elevation, 1,300 feet.]

January	63.6	71	54	15	August	70.4	78	64	10
February	64.1	74	58	14	September	69.1	77	64	9
March	66.3	75	57	15	October	68.5	76	61	13
April	67.2	84	59	18	November	67.4	79	62	17
May	68.0	76	61	13	December	65.6	72	59	12
June	67.7	74	61	12					
July	69.3	78	63	10	The year	67.3	84	54	18

[a] Records for 1 day missing.

Temperature (°F.) at stations on Hawaiian Islands, 1911—Continued.

Kaanapali, Maui.

[Elevation, 12 feet.]

Month.	Mean.	Highest.	Lowest.	Greatest daily range.	Month.	Mean.	Highest.	Lowest.	Greatest daily range.
January	70.2	81	57	21	August	80.0	91	68	22
February	70.4	82	58	22	September	79.4	92	67	23
March	71.4	83	58	22	October	76.5	89	63	22
April	74.0	87	60	23	November	75.2	87	61	23
May	76.0	90	62	23	December	73.0	85	60	23
June	77.3	89	64	25					
July	79.2	90	66	22	The year	75.2	92	57	25

Wailuku, Maui.

[Elevation, 250 feet.]

January	68.8	81	56	21	August	77.4	89	68	18
February	69.2	81	56	25	September	75.8	86	67	14
March	69.8	84	57	24	October	74.0	86	61	21
April	72.2	85	60	21	November	72.8	83	62	18
May	73.0	86	63	18	December	70.9	80	60	18
June	74.1	84	65	17					
July	75.5	86	67	16	The year	72.8	89	56	25

Nahiku, Maui.

[Elevation, 700 feet.]

January	64.2	79	51	21	August	71.0	83	60	19
February	64.0	88	54	21	September	69.1	82	59	20
March	65.4	82	50	24	October	67.8	79	56	21
April	67.0	80	54	19	November	66.8	77	56	21
May	67.8	80	57	23	December	65.5	75	55	16
June	68.2	80	58	20					
July	70.0	83	59	20	The year	67.2	83	50	23

Honomanu, Maui.

[Elevation, 1,800 feet.]

January	63.1	75	51	16	August	68.0	76	61	13
February	62.9	75	55	16	September	66.7	75	60	12
March	65.4	79	54	20	October	66.4	76	59	15
April	65.8	81	54	17	November	65.2	75	59	15
May	66.5	75	57	16	December	63.6	74	58	13
June	65.1	73	59	11					
July	67.2	82	60	23	The year	65.5	82	51	23

Hilo, Hawaii.

[Elevation, 100 feet.]

January	68.4	82	55	25	August	74.6	84	65	18
February	68.7	81	59	19	September	73.8	84	62	19
March	69.4	83	57	23	October	73.0	83	63	19
April	70.8	82	62	17	November	71.4	84	63	20
May	71.3	82	61	17	December	69.6	81	58	20
June	72.4	84	64	18					
July	74.0	88	66	17	The year	71.4	88	55	25

Temperature (°F.) at stations on Hawaiian Islands, 1911—Continued.

Pahala, Hawaii.

[Elevation, 850 feet.]

Month.	Mean.	Highest.	Lowest.	Greatest daily range.	Month.	Mean.	Highest.	Lowest.	Greatest daily range.
January	68.6	85	53	26	August	75.2	91	61	28
February	68.4	84	57	24	September	74.9	89	61	26
March	68.7	82	55	23	October	73.0	88	59	28
April	71.2	84	58	26	November	72.4	87	59	26
May	71.2	87	56	29	December	72.0	87	56	28
June	72.1	88	58	26					
July	74.0	89	60	27	The year	71.8	91	53	29

Waimea, Hawaii.

[Elevation, 2,720 feet.]

January	58.6	73	44	21	August	65.1	79	54	21
February	60.4	74	48	20	September	63.7	78	52	23
March	62.0	75	46	19	October	64.2	78	53	20
April	61.9	76	50	21	November	61.7	76	51	20
May	61.9	76	50	19	December	60.4	75	49	21
June	61.8	72	52	16					
July	63.6	80	53	20	The year	62.1	80	44	23

Humuula, Hawaii.

[Elevation, 6,685 feet.]

January	48.0	63	32	27	August	58.7	72	43	25
February	47.4	65	29	31	September	55.6	68	41	24
March	49.6	64	32	30	October	57.6	70	45	19
April	.....	65	41	.....	November [a]	51.3	66	36	26
May	53.0	64	39	17	December	47.5	63	[b] 35	24
June	54.8	67	42	20					
July	56.8	71	39	29	The year	[c] 52.8	72	29	[c] 31

[a] Records for 1 day missing. [b] Records for 15 days only. [c] For 11 months.

APPENDIX.

PRONUNCIATION OF HAWAIIAN WORDS.

All purely Hawaiian sounds are represented by 12 letters, none of which are ever silent, namely: a, e, h, i, k, l, m, n, o, p, u, and w. The vowels are sounded as follows: a, as in father; e, as in they; i, as in machine; o, as in vote; and u, as in rule or as oo in moon, but not as u in mule. The consonants are sounded as in English except that w is really between English v and w and is sounded like v in the middle of words, especially in the last syllable. Ai, when sounded as a diphthong, resembles English ay in the word aye (yes) or i in bite, and au resembles ou in loud.

Every word and syllable must end in a vowel. Two consonants never stand together without a vowel between, and all consonants are pronounced with the following vowel. Double vowels are pronounced in separate syllables.

The accent is generally on the penult, but some words have the accent on the last syllable.

Vowels are never slurred as in English.

HAWAIIAN WORDS IN COMMON USE.

Ae, yes.
Akamai, smart, clever.
Alanui, street, road.
Alii, persons of high rank.
Alo, front.
Aloha, love (friendly salutation).
Anu, cold.
Anuenue, rainbow.
Aole, no.
Apana, district.
Aupuni, government, nation.
Auwai, ditch.
Auwe, alas.
Awakea, noon.
Eleele, black.
Hale, house.
Halekuai, store.
Halekula, schoolhouse.
Halepule, church.
Haole, white man, or foreigner.
Hapa, half.
Hapahaole, half-white.
Hanahana, to work.
Hapai, lift up.
Heiau, old native temple.
Hele wawai, walk.
Hiamoe, sleep.
Hokele, hotel.
Holoku, native dress, mother hubbard.
Hoomalimali, to gain one's favor by false pretense.
Huhu, angry.
Hui, to unite, company.
Hula, Hawaiian dance.
Huli, to turn.
Iki, little.
Ilio, dog.
Kaaahi, train.
Kaa, carriage.
Kahawai, natural watercourse.
Kahuna, native witch doctor.
Kahunapule, priest.

Kai, sea.
Kamaaina, old-timer, pioneer.
Kamailio, talk.
Kanaka, native, man.
Kanaloa, doubtful.
Kapu, sacred, keep out.
Kapukahi, crooked, bent.
Kaukau, to eat, food.
Kaula, rope.
Keiki, child.
Keikikane, boy.
Keikiwahine, girl.
Kekee, ugly.
Kela, that.
Keokeo, white.
Ko, sugar.
Kokua, to assist, to help.
Konohiki, landlord or his agent.
Kope, coffee.
Kuai, buy, sell.
Kulikuli, keep still.
La, sun.
Lalo, below.
Lanai, porch.
Lani, heaven, sky.
Lau, leaf.
Lei, wreath.
Lepo, earth, sand.
Liilii, small.
Likepu, the same.
Lio, horse.
Luau, native feat.
Luna, superintendent, overseer.
Maanei, here.
Maemae, clean.
Mahina, moon.
Mahoe, twins.
Mahope, by and by.
Mai, come.
Maikai, good.
Maka, eye.
Makai, toward the sea.
Makau, afraid.
Make, dead.
Makeole, alive.
Malaila, there.
Malihini, stranger, tenderfoot.
Maluna, above.
Mamua, before, in front of.
Mano, dam.
Manoa, depth, thickness.
Manu, bird.
Mauka, toward the mountains.
Mauna, mountain.
Mea, thing.
Mele, Hawaiian music.
Menehune, mythical dwarfs.
Moa, chicken.
Moana, ocean.
Moi, king.
Mokuahi, steamer.
Manienie, plain, smooth.
Nana, look.
Nui, big, large.
Ola, living.
Opae, shrimps.
Pa, fence.
Paaa, stony.
Paakiki, hard, difficult.
Pake, chinaman.
Palaoa, bread.
Pali, cliff.
Papa, board, plank.
Pau, done, finished.
Pauloa, all.
Peahi, fan.
Pehea, how goes it?
Pehea oe, how are you?
Peia, thus.
Pilau, offensive to sense of smell.
Pilikia, trouble.
Pipi, cow, beef.
Pohaku, stone.
Poho, to sink.
Poi, native food.
Polorei (?), straight.
Poo, head.
Popoki, cat.
Puaa, hog.
Pueo, owl.
Puka, door, hole.
Pupule, crazy, mad.
Puu, hill, mount.
Ua, rain.
Ukana, load, cargo.
Uku pau, job or piece work.
Ulaula, red.
Wahine, woman.
Wai, water.
Wailele, waterfall.
Wela, hot.
Wikiwiki, hurry up.

MEANING OF GEOGRAPHIC NAMES.[1]

Authorities say that it is difficult or impossible to translate many Hawaiian geographic names on account of their great antiquity and the changes which many of them have undergone. It often happens that different translations will result from dividing a word in different ways. Many names of places in Hawaii are common to the islands of other groups in the South Pacific. These names were probably brought by the earliest colonists and may or may not have had a recognized meaning at that time. They have been used in Hawaii for centuries since the coming of the first colonists without any thought of their original meaning. Most names of places in Hawaii, however, seem to represent some outstanding attribute of the place or to commemorate some occurrence or experience in the life of the people in connection with it.

Some words embody the names of a person of whom no tradition remains; as Ka-wai-a-Hao, the water of Hao; Ka-puu-o-Uo, the hill of Uo.

Many names are evidently attributive, as Mauna Loa, long mountain; Mauna Kea, white mountain; Puu Ulaula, red hill; Ka-lae-loa, the long cape; Ke-ala-i-Kahiki, the way to Kahiki (Tahiti).

The compounds of wai, water, are numerous: as Wai-okea, open water; Wai-aleale, rippling water; Wai-awa, bitter water; Wai-lua, two waters; Wai-manalo, brackish water; Wai-oli, singing water.

Compounds of hono, an obsolete word for harbor, are also numerous: as, Hono-lulu, quiet harbor or Fair Haven; Hono-malino, calm harbor; Hono-manu, bird harbor; Hono-uliuli, blue harbor, etc.

The following refer to Honolulu and vicinity: Ka-imu-ki, the oven for cooking ti root; Ka-lihi, outside edge, or border valley; Ka-moo-iliili, the pebbly or stony strip; Ka-palama, guarded inclosure, or fence of lama wood; Ke-walo, outcry; Manoa, broad valley; Moanalua, two oceans, referring to great expanse of level land and reef; Nuuanu, cool terraces; Palolo, clay valley; Puna-hou, new spring; Pu-o-waina, Punchbowl Hill, signifies the "hill of sacrifice or offering;" and Wai-kiki, spurting water.

GLOSSARY OF SOME GEOGRAPHIC NAMES.[2]

A.

Aa, root.
A'a', rough lava.
Aala, fragrant.
Ahi, fire.
Ahina, gray.
Ahua, a mound, a heap.
Ahualoa, long mound.
'Ai, food, to eat.
Aiea, a shrub, Nothocastrum.
'Aina, land.
Ainakea, white land.

[1] Alexander, W. D., Hawaiian geographic names: Ann. Rept. U. S. Coast and Geodetic Survey for 1902, Appendix 7, 1903, pp. 395–396.

[2] Idem, pp. 396–425.

Akahipuu, one hill.
Akua, a spirit, a deity.
Ala, way.
Alaakua, path of gods.
Alae, mud hen.
Alaea, red ocher.
Alala, a crow.
Alalakeiki, the crying of children.
Ale, a wave.
Aleale, rippling.
Alenuihaha, great waves pursuing.
Alii, a chief.
Alii Puu, royal hill.
Ana, a cave.
Anaana, to pray to death.
Anae, a young mullet.
Anahola, fish poison cave.
Anahulu, ten days.
Anu, cold.
Anuenue, a rainbow.
Ao, light.
Apana, a district.
Apua, cup.
Au, a current, time.
Auau, to bathe, currents.
Auhau, a tax.
Auhuhu, fish poison, *Tephrosia piscatoria.*
Aupokopoko, short time.
Auwaiolimu, mossy water ditch.
Auwana, to wander.
Awa, a harbor.
Awa, a plant, *Piper methysticum.*
Awakee, crooked harbor.
Awalua, two harbors.
Awawaiki, little valley.
Awawaloa, long valley.

E.

Ea, a turtle.
Eha, pain, sore.
Ehoeho, a monument, cairn.
Eleele, black.
Eli, to dig, excavate.

H.

Haaheo, (adj.) proud, pride.
Haalele, to forsake.
Haiki, narrow, close.
Haku, lord.
Hala, Pandanus tree.
Hala, fault, defect.
Halai, a calm.
Halaula, red Hala, Pandanus.
Hale, house.
Haleaha, assembly house.
Haleakala, house of the sun.
Halehaku, master's house.
Haleili, bark house.
Haleili, skin house.
Halekii, house of images.
Halelea, house of joy.
Halemano, shark's house.
Halepuaa, hog's house.
Halepuna, coral house.
Haliimaile, to spread out maile vines.
Haliu, to turn.
Halulu, to roar, rumble.
Hamakua, the back of the island.
Hamakualoa, long Hamakua.
Hamakuapoko, short Hamakua.
Hamama, open.
Hamo, to smear, anoint.
Hana, to work.
Hanalei, make a wreath.
Hanapepe, to crush.
Hanawana, whispering.
Haole, white man, iron.
Hapapa, shallow soil.
Hau, dew, snow.
Hau, a tree, *Hibiscus tiliaceus.*
Hauula, red dew.
Hee, to slide.
Hee, a squid.
Heeia, slide.
Hele, to go.
Hele, a trap.
Hele Puu, traveler's hill.
Helemano, to travel with thousands.
Hihiu, wild.
Hiki, to come.
Hikina, east.
Hilea, lazy.
Hilo, name of an ancient navigator.
Hina, to fall.
Hina, (adj.) gray.
Hiu, a fish's tail.
Hoa, a friend.
Hoalua, two friends.
Hoku, a star.
Hokumahoe, twin stars.
Hokuula, red star.
Hole, to peel, to flay.
Holo, to run.
Holua, a sliding place.
Holualoa, long sled.
Hono, a harbor.
Honohina, Hina's harbor.

Honoipu, calabash harbor.
Honokahau, harbor of the hau tree.
Honokahua, harbor of the fruit.
Honokaia, fish harbor.
Honokala, harbor of the sun.
Honokalani, harbor of the chief.
Honokane, harbor of cane.
Honokawai, harbor of the water.
Honokeana, harbor of the cave.
Honokua, harbor of the back country.
Honolua, two harbors.
Honolulu, fair haven.
Honomakau, fish hook.
Honomalino, calm harbor.
Honomanu, bird harbor.
Honomu', harbor of the mu.
Honopou, post harbor.
Honopu, scorched.
Honopueo, owl harbor.
Honouliuli, blue harbor.
Honu, a turtle.
Honua, land.
Honuapo, dark land.
Honuaula, red land.
Hoolawa, to complete.
Hope, (adj.) after, last.
Hopenui, great end.
Hou, (adj.) new.
Hu, to gush out, to spout.
Hua, a fruit.
Hu'a, sea foam.
Hualele, flying seed.
Hualua, two fruits.
Hue, small gourd, *Lagenaria vulgaris*.
Huelo, a tail.
Huilua, two companies.
Huli, to turn.
Hulihana, seek for work
Hulu, hair, feathers.
Huluhulu Puu, hairy hill.
Humuula, ax stone.
Huna, secret.
Hune, (adj.) poor, destitute.

I.

Ihe, a javelin.
Ihu, nose, break.
Iki, little.
Ili, skin, a division of land.
Iliahi, sandalwood.
Iliili, pebbles.
Iliililoa, long pebbly beach.
Ilio, dog.
Ilole, a mouse, rat.
Iloli, odoriferous.
Imu, an oven.
Iole, rat.
Iwa, nine.
Iwi, a bone.

K.

Ka, the.
Kaa, to roll.
Kaalaea, red ocher.
Kaalawai, water way.
Kaalualu, rough, uneven.
Kaamola, turning round.
Kaao, legend; calm; story.
Kaapahu, cut square off.
Kaauhuhu, the fish poison plant.
Kaawikiwiki, roll quick.
Kaeleku', brittle.
Kaena, room, northwest point.
Kaeo, winner.
Kahakuloa, the long rock.
Kahala, the pandanus.
Kahana, work.
Kahanahaiki, narrow Kahana.
Kahananui, great work.
Kahanui, great mark.
Kahauiki, small hau tree.
Kahauloa, long hau tree.
Kahawai, watercourse.
Kahawaihapapa, shallow aqueduct.
Kahe, to flow.
Kahei, girdle.
Kahiki, Tahiti.
Kahikinui, great Tahiti.
Kahiko, ancient.
Kahili, fly brush.
Kahoahuna, the hidden friend.
Kaholo, the race, the running.
Kahua, foundation, site.
Kahue, the gourd.
Kahui, junction.
Kahuku, prominence.
Kahuna, a priest.
Kai, sea.
Kaiholena, banana.
Kaihuiki, the small nose.
Kaikahi, one sea.
Kaikuono, bay.
Kailio, the dog.
Kailiula, the red bark, red skin.
Kailua, two seas.
Kaimu', the oven.
Kaimuki, the oven for ti root.
Kainalu, surf.

Kainehe, the murmuring sea.
Kaipapau, shallow sea.
Kaiwi, the bone.
Kaiwiki, quick sea.
Kaiwilahilahi, the thin bone.
Kakea, sugar loaf.
Kakio, itch.
Kala, (adj.) rough, prickly.
Kala, end of a house.
Kalae, the cape.
Kalaehonu, cape of the turtle.
Kalaeloa, the long cape.
Kalaeokalaau, cape of the tree.
Kalaeokapahu, cape of the drum.
Kalaepohaku, rocky cape.
Kalaheo, proud day.
Kalahiki, the day of arrival.
Kalala, the limb.
Kalalau, blunder.
Kalaloa, long day.
Kalama, the torch.
Kalamanamana, branching sun.
Kalamaula, red torch.
Kalapa, the ridge.
Kalapamoa, the ridge of fowls.
Kalaupapa, flat leaf of land.
Kalawahine, woman's day.
Kalehua, metrosideros tree.
Kalehua-hakihaki, the broken metrosideros tree.
Kalepa, the flag.
Kali, to wait.
Kalihi, border, edge.
Kalihikai, edge of the sea.
Kalihiwai, edge of the water.
Kaliu, bilgewater.
Kaloi, taro patch.
Kaloko, the fish pond.
Kalokohonu, deep fish pond.
Kalua, the pit or crater.
Kaluahonu, deep pit.
Kaluanui, great pit.
Kalulu, calm.
Kama, child.
Kamalo', dry.
Kamananui, great power.
Kamani, a tree, *Calophyllum inophyllum.*
Kamano, the shark.
Kamaole, childless.
Kamooakua, lizard god.
Kamooiki, small lizard.
Kamuku, cut short.
Kanaueue, vibration, earthquake.
Kaneloa, long cane.
Kaneohe, bamboo cane.
Kaohaoha, fond recollection.
Kaohe, bamboo.
Kaoma, oven.
Kapaa, fast, firm.
Kapaakea, whitish rock.
Kapalama, fence of lama wood.
Kapalepo, dirty inclosure.
Kapaloa, long inclosure.
Kapano, dark colored.
Kapapala, bird lime.
Kapaula, red inclosure.
Kapehu, swelling.
Kapiwai, oozing water.
Kapoho, chalk.
Kapu, taboo.
Kapua, flower.
Kapuai, a foot.
Kapualei, flower wreath.
Kapukaiki, the small outlet.
Kapuna, spring.
Kapunakea, whitish limestone.
Ka-u, the breast.
Kaua, war.
Kauamanu, war of birds.
Kauaula, red war.
Kauhale, village.
Kauhiula, red yarn.
Kauku, the flea.
Kaulana, famous.
Kaumaha, heavy.
Kaumalumalu, shady place.
Kaupakulua, two ridgepoles.
Kawai, the water.
Kawaihae, wild stream.
Kawaihoolana, the buoyant water.
Kawaiiki, little water.
Kawaikapu, forbidden water.
Kawailoa, long water.
Kawainui, great water.
Kawaiolena, yellow.
Kawaluna, upper space.
Kawanui, great time.
Kawela, heat, or hot.
Kea, white.
Kea Mauna, white mountain.
Kea Puu, white hill.
Keaa, burning.
Keahua, mound or hillock.
Kealahewa, wrong way.
Kealahou, new road.
Kealaikahiki, the way to Tahiti.
Kealakaha, marked way.
Kealakekua, path of the gods.

Kealakomo, entering way.
Kealia, salt pan.
Keana, cave.
Keanae, mullet.
Keauhou, new time.
Keawanui, great harbor.
Keawaula, red harbor.
Kee, crooked.
Keekee, crooked.
Kekualele, meteor, shooting star.
Kele, muddy.
Keokea, white.
Ke'oke'o, white.
Keolu, pleasant.
Keoneula, red sand.
Keopu, belly.
Kepio, captive.
Kepuhi, eel.
Kewalo, outcry.
Ki, a plant, *Cordyline terminalis*.
Kihe, sneeze.
Kii, an image.
Kikala, hips.
Kiki, to plaster the hair with lime.
Kilohana, surpassing.
Kilolani, astrologer.
Kini (adj.), numerous.
Kipapa, pavement.
Kipi (adj.), rebellious.
Ko, sugar cane.
Koa, a tree, *Acacia koa*.
Koa, a warrior.
Koae, the tropic bird.
Koaie, a species of koa tree.
Koekoe, cold.
Kohana, naked.
Koheo, stiff.
Kohola, a whale.
Koholalele, leaping whale.
Ko'i, an ax.
Koko, blood.
Koko, a calabash net.
Kole, red, raw, uncooked.
Kolea, plover.
Kolekole, red earth.
Koloa, wild duck.
Kolu, three.
Komo, to enter.
Kona, leeward.
Koolau, windward.
Koolauloa, long Koolau.
Koolaupoko, short Koolau.
Kopili, white kapa.
Kou, a tree, *Cordia subcordata*.
Kowa, a channel.
Kowali, a swing rope.
Kua, a back, a ridge.
Kualoa, long ridge.
Kuhua, hard, thick, as a liquid.
Kukai Puu, dunghill.
Kukui, a tree, *Aleurites moluccana*.
Kukuikea, white Kukui.
Kukuiula, red Kukui.
Kukuluaeo, stilts, the stilt plover.
Kula, dry upland.
Kulani (Hill), heavenly stand.
Kumu, foundation, the trunk of a tree.
Kumukumu, short stumps.
Kumunui, great foundation.
Kumuula, red stump.
Kunu, cough.
Kupua, a magician, wizard.

L.

La, the sun.
Laa, sacred.
Laau, a tree, a plant.
Laaumama, light tree.
Lae, a cape.
Lahilahi, thin.
Lahui, a nation, a tribe.
Laie, leaf of Ie, Freycinetia.
Laimi, day of seeking.
Lala, a branch.
Lama, a torch, a tree, *Maba sandwicensis*.
Lamaloloa, long torch.
Lamanui, great torch.
Lani, the sky, heaven.
Lapa, a narrow ridge.
Lapakea, white ridge.
Lau, a leaf.
Launiupoko, short coconut leaf.
Laupahoehoe, lava leaf.
Lehu, ashes.
Lei, a wreath.
Lele, to fly, leap.
Lena, yellow.
Leo, voice.
Lepo, dirt.
Lepoloa, very dirty.
Lihi, edge.
Lilinoe, mist, fine rain.
Lima, hand.
Limu, moss.
Liu, bilge water.
Loa, long.
Loa Puu, long hill.
Loi, a taro patch.

Loihi, long.
Loko, a fishpond.
Lua, a crater, a pit.
Lua, two.
Luahine Puu, old woman's hill.
Luku, slaughter.
Lulu, to sow.
Lupe, a kite.
Luu, to dive.

M.

Maalo, to pass by.
Mahana, warm.
Mahoe, a twin.
Mahoe Puu, twin hills.
Mahukona, leeward stream or smoke.
Mahuku, to run away, desert.
Maile, a plant, *Alyxia olivæformis*.
Maka, an eye.
Makaeha, sore eye.
Makaha, robbery.
Makanalua, two presents.
Makani, wind.
Makapala, ripe.
Makapuu, on the hill.
Makau, a fishhook.
Makaula, prophet.
Makawao, on the upland.
Makaweli, fearful eye.
Makena, mourning for the dead.
Makole, sore eye.
Makua, parent.
Maláma, month.
Málama, to take care of.
Malino, calm.
Maloo, dry.
Malu, shade.
Mamalu, shade, screen.
Mana, crumb of food, power.
Manalo, brackish.
Manawai, a branch of a stream.
Manawainui, great time.
Maneoneo, a beach grass.
Maneoneo, to itch.
Manienie, smooth, bermuda grass.
Manó, a shark.
Manoa, thick, broad.
Manu, a bird.
Manu Puu, bird hill.
Mau, perpetual.
Maulua, hard, difficult.
Maumau, firm, perpetual.
Mauna, a mountain.
Mauna Kea, white mountain.
Maunalei, mountain of wreaths.
Mauna Loa, long mountain.
Maunalua, two mountains.
Maunaoni, moving mountain.
Maunauna, waste.
Mauu, grass.
Meha, lonely.
Mikimiki, brisk, quick.
Mo'a, cooked.
Moa, a fowl.
Moakea, white fowl.
Moana, ocean.
Moanalua, two oceans.
Moanalulu, smooth ocean.
Moanui, great fowl.
Moaula, red fowl.
Moe, to lie down, to sleep.
Moho, a wingless bird.
Moku, an island, a district.
Mokuhonua, district of level land.
Mokuia, cut, divided.
Mokuleia, a kind of fish.
Mokupapa, level district.
Mokupuni, an island.
Moo, a lizard, a narrow strip of land.
Mooloa, long strip.
Muku, cut short.
Muliwai, a river.

N.

Nahiku, seven lands.
Naholoku, the garments.
Nailiilipoko, short pebbles.
Nakukuikea, white Kukui.
Nakula, uplands.
Nana, to look.
Naniumalu, shady coconut trees.
Nanue, to shake, tremble.
Na Pali, the precipices.
Nawiliwili, wiliwili tree, Erythrina.
Nene, the wild goose.
Nene Puu, goose hill.
Nienie, smooth, calm.
Niho, a tooth.
Niu, a coconut tree.
Niulii, small coconut tree.
Niumalu, shady coconut tree.
Niupuka, coconut tree with a hole through it.
Noho, to sit, to remain.
Nohoiki, little seat.
Nui, great.

Nuku, bill of a bird.
Nuku, a narrow entrance of a river or harbor.
Nuu, a terrace, steps.
Nuuanu, cool terraces.
Nuuanu Pali, cool terraces cliffs.

O.

Ohe, bamboo.
Ohia, a tree, *Metrosideros*, also *Eugenia*.
Ohia Puu, hill of the Ohia, Tantalus.
Ohulehule Puu, bald hill.
Oio, a procession of ghosts.
Ola, life.
Olelo, to speak, a word.
Olelomoana, voice from the ocean.
Olepe, an oyster.
Oli, to sing.
Olohe, naked.
One, sand.
Oneloa, long sand beach.
Ono, sweet.
Oo, ripe.
Oo, a bird, *Acrulocercus nobilis*, from which yellow feathers were taken.
Opae, a shrimp.
Opaeula, red shrimp.
Opea, a cross.
Opipi, a shellfish.
Opu, the belly.

P.

Pa, a fence, an inclosure.
Paa, fast, secure.
Paakea, limestone.
Paauau, bathing inclosure.
Paauhau, tax yard.
Pae, to land.
Paheehee, slippery.
Pahoa, dagger.
Pahoehoe, smooth lava.
Pahu, a stake, a box.
Paia, fish yard.
Paihi, a place where there is a waterfall only in rainy weather.
Pailolo, channel.
Paina, eating.
Pala, a kind of fern.
Pala, ripe.
Palaau, wooden fence.
Pali, a precipice.
Palikea, whitish precipice.
Palolo, clay.
Pamoa, hen yard.
Papa, flat, level.
Papaa, tight, secure.
Papaaloa, dried up, long, tight.
Papai, a crab.
Papohaku, stone wall.
Pau, done, finished.
Pauku, a piece.
Pauku iki, small piece.
Pauku nui, great piece.
Pauwela, burned up.
Pawaa, wild.
Peahi, beckon.
Pelekunu, strong-smelling.
Piapia, sore eye.
Piha, full.
Pii, to ascend.
Piihonua, rising land.
Po, night.
Poe, round.
Pohakea, white rock.
Pohaku, a rock.
Pohakuau, swimming rock.
Pohakuhaku, rocky.
Pohakuloa, long rock.
Póho, a dead calm.
Pohó, to sink.
Pohue, a kind of vine, *Ipomea pescapræ*.
Pokakupuka, pierced rock.
Poko, short.
Pola, the platform of a double canoe.
Polapola, flowing robe.
Polipoli, soft, porous rock.
Poloke, fresh poi.
Pololú, spear.
Pono, right.
Po'o, head.
Poopuaa, hog's head.
Pou, post.
Poupou, short.
Pua, a flower.
Puaa, a hog.
Puaaloa, long pig.
Puakea, pale, whitish.
Puakó, sugar-cane flower.
Puanui, great flower.
Puehu, to scatter.
Pueo, an owl.
Pueokahi, place of owls.
Puhalanui, great Pandanus tree.
Puhi, an eel, to blow.
Puiwa, fright.
Puka, an opening, a door.
Pukalani, heavenly door.

Pulehu, to bake.
Puna, lime, coral.
Punaluu, coral dived for.
Punaula, red coral.
Puowaina, hill of sacrifice.
Pupu, a shell.
Pupukea, white shell.
Puu, a hill.
Puua, rain hill.
Puuhune, hill of poverty.
Puuiki, small hill.
Puukala, rough hill.
Puukole, red, or bare hill.
Puulani, heavenly hill.
Puulena, cool breeze.
Puuloa, long hill.
Puunui, big hill.
Puuwaawaa, hill furrowed with gulches.

U.

U, the breast of a woman.
Ua, rain.
Uhane, a ghost.
Uhi, a yam.
Uhi, to cover.
Uka, inland.
Ula and Ulaula, red.
Ulaula Puu, red hill.
Uli and Uliuli, blue.
Ulu, a breadfruit tree.
Ulumalu, shady breadfruit trees.
Umauma, breast.
Upena, a net.
Uuku, little.

W.

Waa, a canoe, a furrow, channel.
Waawaa, gullied, furrowed.
Waha, a mouth.
Wahiawa, place of awa.
Wahie, firewood.
Wahikuli, deaf place.
Wai, water.
Waihu, a gushing fountain.
Waiaka, laughing water.
Waiakalua, water of the crater.
Waiakea, open water.
Waialae, water of the mud hen.
Waialeale, rippling water.
Waialua, two waters.
Waianu, cold water.
Waiapuka, deceitful water.
Waiau, water to swim in.
Waiau Loko, pond of water.
Waiawa, bitter water.
Waiea, water of the turtle.
Waiehu, clear water.
Waieli, water dug for.
Waihee, water of flight.
Waihi, waterfall.
Waihonu, deep water.
Waikaalulu, quick water.
Waikahekahe, flowing water.
Waikane, water of cane.
Waikapu, forbidden water.
Waikele, muddy water.
Waikiki, spurting water.
Waikoekoe, chilly water.
Waikoko, bloody water.
Waikoloa, wild duck water.
Waikolu, three waters.
Wailau, four hundred streams.
Wailau, many waters.
Wailea, water of pleasure.
Wailele, waterfall.
Wailoa, long water.
Wailua, two waters.
Wailuaiki, little two waters.
Wailuku, bloody or dirty water.
Waimalu, shaded water.
Waimanalo, brackish water.
Waimano, many waters.
Waimanu, bird water.
Waimea, a kind of tree.
Waimuku, water cut short.
Wainaku, water of rushes.
Wainiha, rude, wild water.
Waiohinu, water of slime.
Waioli, singing water.
Waiomao, green water.
Waioni, moving water.
Waiono, sweet water.
Waiopua, water of flowers.
Waipio, curving water.
Waipouli, water of darkness.
Waipunalei, spring of wreaths.
Waipunaula, red spring of water.
Wanana, a prophecy.
Wela, hot.
Weliweli, terrible.
Weliwelinui, great terror.
Wiki, quick, swift.

PRINCIPAL WATERCOURSES, BY ISLANDS.

KAUAI.

[Streams are arranged counterclockwise, beginning at the west. Tributaries indicated by indention.]

Waimea River.
- Halemanu Stream.
- Kokee Stream.
- Poomau River.
  - Kauaikanana Stream.
  - Kawaikoi Stream.
    - Waiakoali Stream.
  - Mohihi Stream.
- Koaie River.
- Waialae River.
- Mokihana Stream.
- Makaweli River.
  - Makuone Stream.
  - Halekua Stream.
  - Olokele River.
    - Kahana Stream.

Waipau Gulch.
Aakukui Gulch.
Mahinauli Gulch.
Hanapepe River.
- Hiloa Stream.
- Manuahi Stream.

Wahiawa Stream.
Lawai Stream.
Waikomo Stream.
Huleia River.
- Kamooloa Stream.
- Haleaanahu Stream.

Nawiliwili Stream.
Hanamaula Stream.
Wailua River.
- South Fork of Wailua River.
  - Waiahi Stream.

Wailua River—Continued.
- North Fork of Wailua River.
  - Uhau Iole Stream.
  - Keahua Stream.
  - Kawi Stream.
- Opaikaa Stream.

Konohiki Stream.
Kaehulua Stream.
Kapaa River.
- Kapahi Stream.
- Kealia Stream.

Anahola River.
- Keaoopu Stream.

Papaa Stream.
Moloaa Stream.
Kilauea River.
Pookumu Stream.
Kalihiwai River.
Anini Stream.
Hanalei River.
Waioli Stream.
Waipa Stream.
Lumahai River.
Wainiha River.
Limaluli Stream.
Hanakapiai Stream.
Hanakoa Stream.
Kalalau Stream.
Honopu Valley.
Awaawapuhi Valley.
Nuulolo Valley.
Kaahole Valley.
Milolii Valley.
Makaha Valley.

OAHU.

[Streams are arranged in clockwise order, beginning at the southeast.]

Waialae Stream.
Palolo Stream.
- Waiomao Stream.
- Pukele Stream.

Manoa Stream.
Makiki Stream.
Nuuanu Stream.
- Pauoa Stream.
- West Branch of Nuuanu Stream.

Kalihi Stream.
Moanalua Stream.
Halawa Stream.
Aiea Stream.
Kalauao Stream.
Waimalu Stream.
Waiawa Stream.
- Manana Stream.

Waipahu Stream.
- Kipapa Gulch.
- Waikakalaua Stream.
- Waieli Gulch.

Honouliuli Gulch.
Mailiili Stream.
Waianae Stream.

Makaha Stream.
Kaukonahua Stream.
    North Fork of Kaukonahua Stream.
    South Fork of Kaukonahua Stream.
    Waikoloa Gulch.
    Mohiakea Gulch.
    Pulee Gulch.
    Poamoho Stream.
Helemano Stream.
Opaeula Stream.
Anahulu Stream.
Waimea River.
Kaipapau Stream.
Hauulu Stream.
Kaluanui Stream.
Punaluu Stream.
Kahana Stream.
Waikane Stream.
Waiahole Stream.
    Waihi Stream.
    Halona Stream.
    Waianu Stream.
Kaalaea Stream.
Waihee Stream.
Kahaluu Stream.
Heeia Stream.
Kaneohe Stream.
    Kawa Stream.
Kailua Stream.
    Kahanaiki Stream.
Waimanalo Stream.

MAUI.

[Streams are arranged as follows: West Maui, clockwise beginning at Waihee Stream at the northeast; East Maui, from west to east, and from Hana, west.]

WEST MAUI.

Waihee Stream.
Waiehu Stream.
    North Waiehu Stream.
    South Waiehu Stream.
Iao Stream.
Waikapu Stream.
Manawainui Gulch.
Ukumehame Stream.
Olowalu Stream.
Launiupoko Stream.
Kauaula Stream.
Kahoma Stream.
    Lahainaluna Stream.
Wahikuli Gulch.
Honokawai Stream.
Mailepai Stream.
Honokahua Stream.
Honolua Stream.
Honokahau Stream.
Keawalua Stream.
Poelua Stream.
Hononana Stream.
Waihale Stream.
Kahakuloa Stream.
Mana Stream.
Makamakaole Stream.

EAST MAUI.

Maliko Gulch.
West Kuiaha Stream.
    Lilikoi Stream.
East Kuiaha Stream.
Manawaiiao.
Uaoa Stream.
Halehaku Stream.
    Opana Stream.
Kapaalalaea Stream.
Honopou Stream.
Hoolawa Stream.
    Hoolawanui Stream.
    Hoolawaliilii Stream.
Huelo Stream.
Hoalua Stream.
Hanawana Stream.
Kailua Stream.
    Oanui Stream.
Nailiilihaele Stream.
Nailiilihaeleliilii Stream.
Papaaea Stream.
Oopuola Stream.
Punaluu Stream.
Kolea Stream.
Waikamoi Stream.
    Alo Stream.
Puohakamoa Stream.
Haipuaena Stream.
Kolea Stream.
Honomanu Stream.
    Ulawina Stream.
Nuaailua Stream.
West Keanae Stream.
East Keanae Stream.
Wailuanui Stream.
West Wailuaiki Stream.
East Wailuaiki Stream.

Kopiliula Stream.
Waiohue Stream.
Paakea Stream.
Waiaaka Stream.
Kahaula Stream.
Hanawi Gulch.
Makapipi Gulch.
Kahawaihapapa Gulch.
Kawaipapa Gulch.
Waikapaia Gulch.
Waiohomi Gulch.
Mooiki Gulch.
Kahanaiokapia Gulch.
Waiohonu Gulch.
Pukuilua Gulch.
Papahanahana Gulch.
Alaaloula Gulch.
Waikakoi Gulch.
Paihi Gulch.
Manamana Stream.
Honolewa Stream.
Waieli Stream.
Kaili Stream.
Hahalawe Stream.
Maluhonaiwi Stream.
Puaaluu Stream.
Oheo Stream.
Kalewa Stream.
Koukouai Stream.
Opelu Stream.
Kuikuiula Stream.
Lelekeanu Stream.
Lelekeoili Stream.
Alelele Stream.
Kalepa Stream.
Nuanualoa Stream.
Mokulau Stream.
Manawainui Stream.

HAWAII.

[Streams are arranged from south to north, beginning at Hilo.]

Wailuku River.
  Kapehu Stream.
  Awehi Stream.
Pukihae Stream.
Pohakunanaka Stream.
Honolii River.
  Maili Stream.
  Kikola Stream.
  Pohakupaa Stream.
Kumunuiakea Stream.
Waipahoehoe Stream.
Kapue (or Papaikou) Stream.
Kaieie Stream.
Aleamai Stream.
Kalaoa Stream.
Hanawai Stream.
Onomea Stream.
Kawainui River.
Waiaama Stream.
Pepeekeo Stream.
Kapeha Stream.
Makoewai Stream.
Makea Stream.
Honomu Stream.
Kapahehe Stream.
Kolekole Stream.
Kaahakini Stream.
Hakalau Stream.
Umauma Stream.
  Haunapueo Stream.
  Wailua Stream.
Eehui (Peleau) Stream.
Opea Stream.
Nanue Stream.
Waiehu Stream.
Waikaumalo Stream.
Waimalino Stream.
Pulili Stream.
  Kaleiiki Stream.
  Kapena Stream.
Waikola Stream.
Kaoheiki Stream.
Ninole Stream.
Puuohua Stream.
Manoloa Stream.
Poopoo Stream.
Kahina Pukii Stream.
Ahole Stream.
Papaa (Kulanakii) Stream.
Pohakupuka Stream.
Huliilii Stream.
Okole Stream.
Puu Olii Stream.
Maulua Stream.
Koheaka Stream.
Weloka Stream.
Keaalau Stream.
Kapehu Stream.
Moanalulu Stream.
Papaaloa Stream.
Kihalani Stream.
Hokumahoe Stream.

Manowaiopae Stream.
Puu Alaea Stream.
Kilau Stream.
Laupahoehoe Gulch.
Waipunalei Gulch.
Kawalii Gulch.
Ookala Gulch.
Paauilo Gulch.
Numerous gulches between Ookala Gulch and Waipio River dry, except during or immediately after storms.
Waipio River.
Kawainui Stream.
Waipio River—Continued.
Alakahi Stream.
Koiawe Stream.
Waima Stream.
Numerous small streams from Waipio River to Waimanu Stream.
Waimanu Stream.
Streams between Waimanu and Awini Streams.
Awini Stream.
Honokane Stream.
Pololu Stream.
Small streams north of Pololu Stream.

GAZETTEER.

Aahoaka, prominent hill, Lihue district, Kauai; between North and South forks of Wailua River; elevation, 805 feet.

Aakukui, gulch, Waimea district, Kauai.

Ahole, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea south of Maulua Gulch.

Ahukini, sugar and freight landing on Hanamaulu Bay, Kauai.

Aiea, land division in Government ownership, Ewa district, Oahu.

Aiea, village and post office on East Loch of Pearl Harbor, Oahu; site of Honolulu Plantation Co.'s mill.

Alakahi, tributary of Waipio River, Hamakua district, Hawaii; rises on northeastern slope of Kohala Mountains, entering Waipio River from the west.

Alakai, swamp in extreme northern part of Waimea River basin; drains southward through tributaries of Waimea River.

Alalakeiki, channel between Maui and Kahoolawe Islands; width, 6 sea miles.

Aleamai, small stream on lower eastern slope of Mauna Kea, Hawaii, entering sea north of Papaikou.

Alelele, small stream, Hana district, Maui; rises on southwestern slope of Haleakala; flows southward into sea west of Kipahulu.

Alenuihaha, channel between Maui and Hawaii Islands; width, 26 sea miles.

Aliapaakai, salt lake near sea level in old crater, west of Honolulu, Oahu.

Aliomanu, land division partly in Government ownership; Kawaihau district, Kauai.

Alo, small stream, Hana district, Maui; rises on northern slope of Haleakala; flows northeastward into Waikamoi Stream from the east; water taken into Spreckels ditch at Alo division weir.

Amalu, stream, Lahaina district, Maui; rises on northwestern slope of West Maui, tributary to Honokawai Stream from the north.

Anahola, bay at mouth of Anahola Stream, northeast Kauai.

Anahola, land division in Government ownership, Kawaihau district, Kauai.

Anahola, stream, Kawaihau district, Kauai; rises on northern slope of Pueo Peak; flows eastward into Anahola Bay; water used for cane and rice irrigation.

Anahola, village and landing on Anahola Bay, Kawaihau district, Kauai.

Anahulu, stream, Waialua district, Oahu; rises in northern Koolau Mountains; flows northwestward into Waialua Harbor; water used for cane irrigation.

Apua, land division in Government ownership, Puna district, Hawaii.

Auau, channel between Maui and Lanai Islands; width, 7 sea miles.

Auwahi, large land division, Hana district, Maui.

Awawaloa. (See Olympus.)

Awehi, stream, South Hilo district, Hawaii; rises on southeastern slope of Mauna Kea; flows southeastward, entering Wailuku Stream from the north.

Awini, stream, Kohala district, Hawaii; rises on northern slope of Kohala Mountains; flows northward into sea east of Honokane Gulch.

Barber's Point. (See Laeloa.)

Barking Sands, range of windblown sand hills extending half a mile northward from Nohili Point, west Kauai. When thoroughly dry these sands emit a variety of resonant sounds whenever the grains are disturbed; this phenomenon is a rare one, said to be common to only a few places in the world.

Center ditch, diversion from Puohakamoa Stream, East Maui, extending westward across country on a gentle grade to Nailiilihaele Stream at the intake of Haiku and Lowrie ditches, and intercepting the various streams on its way.

China ditch, Hanalei district, Kauai; diverts water from the west side of Hanalei River for rice irrigation.

Diamond Head (Leahi), prominent picturesque tufa-cone crater, forming most southern point of Oahu, just east of the city of Honolulu; the rim of the crater is a complete circle, with the highest point on the south side (elevation, 761 feet); lighthouse and military reservation from which firing of all forts on Oahu can be directed.

Eahua, land division, North Kohala district, Hawaii.

Eehui, small stream on lower eastern slope of Mauna Kea, Hawaii, entering sea near Honohina.

Eke, crater peak on West Maui, a few miles north of Puu Kukui; elevation, 4,500 feet.

Eleele, ditch, Koloa district, Kauai; diverts water from the west side of Wahiawa Stream for cane irrigation.

Eleele, landing on Hanapepe Bay, South Kauai.

Eleele, village and post office, Koloa district, Kauai.

Ewa, district, in city and county of Honolulu; political subdivision in south-central Oahu; population (1910), 14,627.

Ewa Mill, town and post office, Ewa district, Oahu; site of Ewa Plantation Co.'s mill.

Glenwood, village and terminus of Volcano branch of Hilo Railroad, about 9 miles from Kilauea Volcano.

Haena, caves in cliff on Haena coast, north Kauai; large unexplored caves at sea level filled with sweet water; visited by tourists.

Haena, land division, Hanalei district, Kauai.

Haena, point west of Hanalei Bay, north Kauai.

Hahalawe, small stream, Hana district, Maui; rises on southeastern slope of Haleakala; flows southeastward into sea east of Kipahulu.

Haiku, land division, Makawao district, Maui.

Haiku, large land division, Lihue district, Kauai.

Haiku, ditch, East Maui; heads in Nailiilihaele Stream near Kailua; extends westward across country on a rather steep grade to cane lands in the vicinity of Spreckelsville and Puunene, intercepting all streams on the way; length, about 30 miles; one of the earlier ditches on East Maui, now being reconstructed.

Haiku, village and post office, just east of Maliko Gulch, Maui.

Haipuaena, stream, Hana district, Maui; rises on northern slope of Haleakala; flows northeastward into sea; supplies water to Spreckels ditch.

Hakalau, land division, North Hilo district, Hawaii.

Hakalau, small bay at mouth of Hakalau Gulch, east Hawaii.

Hakalau, stream, South Hilo district, Hawaii; rises on eastern slope of Mauna Kea; flows northeastward into sea at Hakalau.

Hakalau, village, post office, and freight landing, South Hilo district, Hawaii.

Halawa, land division, Ewa district, Oahu.

Halawa, large land division, eastern Molokai.

Halawa, stream, eastern Molokai; rises at about 3,000 feet elevation; flows northeastward into sea through Hawala Gulch; water used for taro irrigation.

Halawa, stream, Ewa district, Oahu; rises in Koolau Mountains; flows southwestward through Halawa Gulch to East Loch of Pearl Harbor; part of freshet flow used for cane irrigation.

Haleakala, crater, East Maui; largest extinct crater in the world; area, 19 square miles; circumference, 20 miles; extreme length, 7.48 miles; extreme width, 2.37 miles; elevation of summit, 10,032 feet; depth, 2,000 feet.

Haleakala, extinct volcanic mountain of East Maui; elevation of highest point, 10,032 feet; has largest crater in the world.

Halehaku, large land division, Makawao district, Maui.

Halehaku, stream, Makawao district, Maui; rises on northern slope of Haleakala; flows northward into sea through a deep gulch, contributing water to several of the East Maui ditches; principal tributary, Opana Stream, which enters from the west.

Haleiwa, village and post office, Waialua district, Oahu.

Halemanu, peak at upper end of Waimea Canyon, Kauai; elevation, 3,700 feet.

Halemanu, small stream, upper Waimea basin, Kauai; westernmost tributary of Waimea River.

Halemaumau, pit and lake of fire in floor of Kilauea Crater, Hawaii; level and dimensions of lake vary from time to time; ordinarily, level is about 250 feet below the rim of the pit, and the dimensions, 250 by 400 feet.

Hamakua, district, Hawaii County; political subdivision in windward northern Hawaii; population (1910), 9,037.

Hamakua (New), ditch, Hamakua district, Hawaii; diverting water from branches of Waipio River at about 1,000 feet elevation for cane irrigation.

Hamakua (New), ditch, east Maui; begins at Alo division weir at the west end of Koolau ditch, taking two-thirds of the Koolau ditch water; extends westward across country on a gentle grade to serve the higher cane lands above Hamakuapoko, and the area to the west, intercepting all streams from Nailiilihaele westward.

Hamakua (Old), ditch, east Maui; intake, originally in Nailiilihaele Stream, now abandoned as far as Lupi, where it crosses the New Hamakua ditch; extends westward from Lupi across country on steep grade to cane lands near Hamakuapoko.

Hamakua (Upper), ditch, Hamakua district, Hawaii; diverting water from branches of Waipio River at a high elevation for fluming and irrigation purposes.

Hamakualoa, name of an old district on northeast slope of Haleakala, East Maui; now included in Makawao district.

Hamakuapoko, land division, Makawao district, Maui.

Hamakuapoko, name of an old district on northern slope of Haleakala, East Maui; now included in Makawao district.

Hamakuapoko, village and post office, Makawao district, Maui; site of Maui Agricultural Co.'s mill.

Hana, bay and landing, at eastern end of Maui.

Hana, district, Maui County; political subdivision in southeastern Maui; population (1910), 3,241.

Hana, village and post office, at east end of Maui; site of Kaeleku Sugar Co.'s mill.

Hanahanapuni, a hill on divide between North and South forks of Wailua River, Kauai; elevation, 911 feet.

Hanakaoo, land division, Lahaina district, Maui.

Hanakapiai, short stream, Napali section, Hanalei district, Kauai; flows northward into sea.

Hanakoa, short stream, Napali section, Hanalei district, Kauai; flows northward into sea.

Hanalei, bay at mouth of Hanalei River, north Kauai.

Hanalei, district, Kauai County; political subdivision in northern Kauai; population (1910), 2,457.

Hanalei, large land division, chiefly in Government ownership, Hanalei district, Kauai.

Hanalei, large stream, Hanalei district, Kauai; navigable for short distance above mouth; rises on northern slope of Waialeale; flows northward into Hanalei Bay; receives numerous short tributaries from east and west; water used for large area of rice land in Hanalei Valley.

Hanalei, village, post office, and landing, Hanalei district, Kauai.

Hanamaulu, stream, Lihue district, Kauai; rises on northern slope of Kilohana Crater; flow seastward into Hanamaulu Bay; water used for rice irrigation in lower part of valley.

Hanamaulu, bay at mouth of Hanamaulu Stream, east Kauai.

Hanamaula, ditch, Lihue district, Kauai; diverts water from the south side of South Fork of Wailua River for cane irrigation.

Hanamaulu, large land division, Lihue district, Kauai.

Hanamaulu, village, Lihue district, Kauai; site of Lihue Plantation Co.'s Hanamaulu Mill.

Hanapepe, bay at mouth of Hanapepe River, south Kauai.

Hanapepe, ditch, Waimea district, Kauai; diverts water from Hanapepe and Hiloa streams for cane irrigation.

Hanapepe, falls on Hanapepe River, Kauai; height, 362 feet; distance from the sea, 8 miles.

Hanapepe, large land division in Government ownership, Waimea and Koloa districts, Kauai.

Hanapepe, river, forming boundary between Waimea and Koloa districts; rises on southern slope of Kawaikini; flows southwestward into Hanapepe Bay; receives flow of several tributaries from east and west; water used for cane and rice irrigation. Hanapepe Falls are on this stream, about 8 miles from its mouth.

Hanapepe, village and post office in Hanapepe Valley, Koloa district, Kauai.

Hanawai, stream, South Hilo district, Hawaii; rises on eastern slope of Mauna Kea; flows eastward into sea between Papaikou and Pepeekeo.

Hanawana, small stream, Makawao district, Maui; rises on the northern slope of Haleakala; flows northward into sea, just west of Kailua; crossed by three East Maui ditches.

Hanawi, stream, Hana district, Maui; rises on eastern slope of Haleakala; flows northeastward into sea; supplies water to Nahiku ditch.

Haunapueo, small tributary of Umauma Stream on eastern slope of Mauna Kea, Hawaii.

Haupo, peak on Koloa-Lihue divide, Kauai; elevation, 2,280 feet.

Hauula, land division partly in Government ownership, Koolauloa district, Oahu.

Hauula, settlement and hotel, Koolauloa district, Oahu; 31 miles from Honolulu.

Hauulu, small stream, Koolauloa district, Oahu; rises in northern Koolau Mountains; flows northeastward into sea.

Hawaii, county in Territory of Hawaii at southeastern end of group; includes only Hawaii Island; population (1910), 55,382.

Hawaii, island at southeast end of group, 134 sea miles from Honolulu; consists of several mountain peaks 20 to 25 miles apart, with high intermontane areas; highest point, 13,825 feet; roughly triangular in shape; 90 miles long and 75 miles wide; area, 4,015 square miles; population (1910), 55,382; has two active craters, Kilauea being the largest active crater in the world; called the "Big Island."

Hawi, village, North Kohala district, Hawaii.

Heeia, land division, Koolaupoko district, Oahu.

Heeia, stream, Koolaupoko district, Oahu; rises in Koolau Mountains; flows northeastward into Kaneohe Bay; water used for rice irrigation.

Heeia, village and post office, Koolaupoko district, Oahu.

Helemano, ditch diverting water from Poamoho and Helemano streams, Oahu, for cane irrigation.

Helemano, stream, Waialua district, Oahu; rises in northern Koolau Mountains; flows northwestward into Kaiaka Bay; water used for cane irrigation.

Hiilawe, high falls in Waipio Gulch; height, about 1,700 feet.

Hilea, land division, Kau district, Hawaii.

Hilea, village, Kau district, Hawaii.

Hilo, large bay at mouth of Wailuku River, east Hawaii.

Hilo, principal harbor on Hawaii Island; extensive improvements now under way for the accommodation of all kinds of shipping.

Hilo, town, beautifully situated on Hilo Bay, Hawaii; second largest in the Territory; population, about 7,000.

Hilo, N., district, Hawaii County; political subdivision in central windward Hawaii; population (1910), including S. Hilo district, 22,545.

Hilo, S., district, Hawaii County; political subdivision in eastern Hawaii; population (1910), including N. Hilo district, 22,545.

Hiloa, stream, Waimea district, Kauai; tributary to Hanapepe Stream from the west, below Hanapepe Falls.

Hoaeae, land division, Ewa district, Oahu.

Hoalua, small stream, Makawao district, Maui; rises on northern slope of Haleakala; flows northward into sea; crossed by three East Maui ditches.

Hokukano, land division partly in Government ownership, Kau district, Hawaii.

Hokumahoe, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea north of Papaaloa.

Holualoa, village and post office, North Kona district, Hawaii.

Homestead, post office and store, Koloa district, Kauai.

Honaunau, land division, South Kona district, Hawaii.

Honaunau, small bay, South Kona coast, Hawaii.

Honaunau, village and landing, South Kona district, Hawaii.

Honohina, land division, North Hilo district, Hawaii.

Honohina, village and freight landing, North Hilo district, Hawaii.

Honoipu, freight landing, North Kohala district, Hawaii.

Honokaa, town, post office, and freight landing, Hamakua district, Hawaii.

Honokahau, land division, North Kona district, Hawaii.

Honokahau, large ditch, West Maui, diverting water from Honokahau and Honolua streams; length, from intake to Honokawai weir, 13 miles; used for cane irrigation.

Honokahau, large land division in Lahaina district, Maui.

Honokahau, long stream, Lahaina district, Maui; rises on northern slope of West Maui near the summit; flows northward into sea; water diverted through Honokohau ditch for cane irrigation, and through other smaller ditches for taro irrigation.

Honokahau, village and post office on north coast of West Maui.

Honokahua, large land division, Lahaina district, Maui.

Honokahua, small stream, Lahaina district, Maui; rises on northwestern slope of West Maui; flows northwestward, only flood waters reaching the sea.

Honokaia, land division in Government ownership, Hamakua district, Hawaii.

Honokane, land division, North Kohala district, Hawaii.

Honokane, stream, Kohala district, Hawaii; rises high up on northern slope of Kohala Mountains; flows northward into sea through Honokane Gulch.

Honokawai, ditch diverting water from south side of Honokawai Stream, West Maui, for power and irrigation.

Honokawai, large land division in Government ownership, Lahaina district, Maui.

Honokawai, stream, Lahaina district, Maui; rises on northwestern slope of West Maui; flows northwestward into sea; receives the flow of Amalu Stream from the north; water diverted for power and irrigation.

Honokua, land division, South Kona district, Hawaii.

Honolewa, stream, Hana district, Maui; rises on southeastern slope of Haleakala; flows southeastward into sea, near Wailua.

Honolii, stream, South Hilo district, Hawaii; rises on upper eastern slope of Mauna Kea; flows southeastward into sea a few miles north of Hilo; receives several tributaries, the largest of which is Maili Stream from the south.

Honolua, landing on north coast of West Maui.

Honolua, small stream, Lahaina district, Maui; rises on northwestern slope of West Maui; flows northwestward into sea; water diverted through Honokohau ditch for cane irrigation.

Honolulu, capital and metropolis of Hawaiian Islands, situated on the south coast of Oahu; population (1910), 52,183; port of call for all trans-Pacific steamers and home port for all interisland steamers.

Honolulu, city and county in Territory of Hawaii, including only the island of Oahu; population (1910), 81,993.

Honolulu, district, in city and county of Honolulu; political subdivision in leeward southeastern Oahu; population (1910), 52,183.

Honolulu, harbor on south coast of Oahu, best harbor in group and port of call for trans-Pacific steamers.

Honomanu, large land division in Government ownership, Hana district, Maui.

Honomanu, large stream, Hana district, Maui; rises high up on northern slope of Haleakala; flows northeastward into sea through a very deep gulch which extends considerable distance back from sea; supplies water to Spreckels ditch.

Honomilino, land division, partly in Government ownership, South Kona district, Hawaii.

Honomu, small stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea south of Honomu post office.

Honomu, village, post office, and freight landing, South Hilo district, Hawaii.

Honopou, small stream, Makawao district, Maui; rises on the north slope of Haleakala; flows northward into sea, crossing four East Maui ditches.

Honouliuli, large land division, Ewa district, Oahu.

Honouliwai, land division in Government ownership, southeastern Molokai.

Honuapo, village, freight and passenger landing, Kau district, Hawaii.

Honuaula, homestead section, North Kona district, Hawaii.

Honuaula, name of old district in the southwestern part of East Maui; now included in Makawao district.

Hookena, land division, South Kona district, Hawaii.

Hookena, village, post office, and passenger landing, South Kona district, Hawaii.

Hoolawa, stream, Makawao district, Maui; rises on the northern slope of Haleakala; flows northward into sea, crossing four East Maui ditches.

Hoolehua, large land division in Government ownership, northern Molokai.

Hoopuloa, village, post office, and passenger landing, South Kona district, Hawaii.

Hualalai, mountain, western Hawaii; elevation, 8,275 feet; like Mauna Kea, it has no crater on its summit.

Huehue, village, North Kona district, Hawaii.

Huelo, small stream, Makawao district, Maui; rises on northern slope of Haleakala; flows northward into sea, west of Huelo village; crosses three East Maui ditches.

Huelo, village and post office, East Maui.

Huleia, stream, Lihue district, Kauai; rises on eastern slope of main divide; flows southeastward to Nawiliwili Bay; water used for cane irrigation.

Huliilii, very small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea near Maulua Gulch.

Humuula, very large and long land division in Government ownership, North Hilo district, Hawaii.

Iao, large land division, Wailuku district, Maui.

Iao, large stream, Wailuku district, Maui; rises near summit of East Maui; flows eastward through deep canyon and valley into sea; receives the flow of several tributaries; water diverted through several ditches for cane and taro irrigation.

Iao, picturesque amphitheater valley, West Maui; length (above Wailuku), about 5 miles; width, 1 to 2 miles; depth, near head, about 4,000 feet; elevation of Puu Kukui, overlooking valley, 5,790 feet; called the "Yosemite of Hawaii."

Kaahakini, small stream on lower eastern slope of Mauna Kea, Hawaii, entering the sea just south of Hakalau post office.

Kaala, peak, Waianae Range, West Oahu; elevation, 4,030 feet; highest point on island of Oahu.

Kaalaea, land division, Koolaupoko district, Oahu.

Kaalaea, stream, Koolaupoko district, Oahu; rises in Koolau Mountains; flows eastward into Kaneohe Bay; water used for rice irrigation.

Kaanapali, landing on west coast of West Maui.

Kaanapali, name of an old district on north side of West Maui; now included in Lahaina and Wailuku districts.

Kaapahu, homestead section, Hamakua district, Hawaii.

Kaapuna, land division, South Kona district, Hawaii.

Kaawaloa, land division, South Kona district, Hawaii.

Kaehulua, small stream, Kawaihau district, Kauai; flows eastward into sea; water used for cane irrigation.

Kaena, land division in Government ownership, Waialua district, Oahu.

Kaena, sharp point at west end of Oahu.

Kahakuloa, large land division in Government ownership, Wailuku district, Maui.

Kahakuloa, point on northeast coast of West Maui, at mouth of Kahakuloa Valley.

Kahakuloa, stream, Wailuku district, Maui; rises on northern slope of west Maui; flows northeastward into sea; water used for taro irrigation.

Kahakuloa, village at mouth of Kahakuloa Valley, East Maui.

Kahaluu, land division, Koolaupoko district, Oahu.

Kahana, land division, Koolauloa district, Oahu.

Kahana, stream in central Waimea basin, Kauai; tributary to Olokele River from the north.

Kahana, stream, Koolauloa district, Oahu; rises in Koolau Mountains; flows northeastward into Kahana Bay; water used for irrigation.

Kahana, village and post office, Koolauloa district, Oahu.

Kahanahaiki, land division in Government ownership, Waianae district, Oahu.

Kahanui, land division, central Molokai.

Kahaualea, large land division, Puna district, Hawaii.

Kahauiki, land division, Honolulu district, Oahu; U. S. Military Reservation.

Kahaula, small stream, Hana district, Maui; rises on eastern slope of Haleakala; flows northeastward into sea; supplies water to Nahiku ditch.

Kahauloa, land division, South Kona district, Hawaii.

Kahawaihapapa, deep gulch east of Nahiku, East Maui.

Kahikinui, name of an old district on the southeastern slope of Haleakala, East Maui; now included in Hana district.

Kahili, land division, Hanalei district, Kauai.

Kahili, peak on the main divide at the head of Huleia River, Kauai; elevation, 3,016 feet.

Kahina Pukii, very small stream on lower eastern slope of Mauna Kea, Hawaii, entering sea south of Maulua Gulch.

Kahoma, ditch diverting water from north side of Kahoma Stream, West Maui; for cane irrigation.

Kahoma, stream, Lahaina district, Maui; rises on western slope of West Maui; flows westward into sea; receives the flow of Lahainaluna Stream from the south; water diverted for cane irrigation through Kahoma ditch.

Kahoolawe, island in public ownership south of Maui and 6 sea miles distant; highest point, 1,472 feet; area, 44 square miles; population (1910), 2; included in Makawao district, Maui County.

Kahuku, land division in Koolauloa district, Oahu.

Kahuku, point, at north end of Oahu.

Kahuku, very large land division in Kau district, Hawaii; extends from sea to summit of Mauna Loa.

Kahuku, village and post office, Koolauloa district, Oahu; site of Kahuku Plantation Co.'s mill; northern terminus of Oahu Railroad, 69½ miles from Honolulu by rail.

Kahului, bay and harbor, on north coast of Maui.

Kahului, town and post office, on Kahului Harbor, Maui; chief shipping port for Maui.

Kaiaka, small bay at mouth of Kaukonahua Stream, northwest Oahu.

Kaieie, small stream on lower eastern slope of Mauna Kea, Hawaii, entering the sea near Papaikou.

Kaieiewaho, channel between Oahu and Kauai Islands; width, 63 sea miles; also called Kauai Channel.

Kaiholena, land division, North Kohala district, Hawaii.

Kaili, small stream, Hana district, Maui; rises on southeastern slope of Haleakala; flows southeastward into sea.

Kailua, land division, Koolaupoko district, Oahu.

Kailua, principal bay, north Kona coast, Hawaii.

Kailua, settlement, east of Huelo (post office, Huelo), East Maui.

Kailua, shallow bay at mouth of Kailua Stream, east Oahu.

Kailua, stream, Koolaupoko district, Oahu; rises in southern Koolau Mountains; flows northeastward into Kawainui Swamp, and thence into the sea; receives numerous tributaries in the upper part of its course; water used for rice irrigation.

Kailua, stream, Makawao district, Maui; rises high up on northern slope of Haleakala; flows northeastward into sea; supplies water to two East Maui ditches; principal tributary, Oanui Stream.

Kailua, village and post office on Kailua Bay, North Kona district, Hawaii.

Kaimuki, hill and residential section of Honolulu, Oahu, just back of Diamond Head; elevation, 291 feet.

Kainaliu, village, North Kona district, Hawaii.

Kai o Kalohi, channel between Molokai and Lanai Islands; width, 7 sea miles.

Kaipapau, land division partly in Government ownership, Koolauloa district, Oahu.

Kaipapau, small stream, Koolauloa district, Oahu; rises in northern Koolau Mountains; flows northeastward into sea.

Kaiwi, channel between Oahu and Molokai Islands; width, 23 sea miles.

Kaiwiki, land division in Government ownership, South Hilo district, Hawaii.

Kakaako, low flat section of Honolulu on the water front, Oahu, east of harbor.

Ka Lae, extreme southern point of Hawaii.

Kalaheo, land division, partly in Government ownership, Koloa district, Kauai.

Kalahiki, land division, South Kona district, Hawaii.

Kalala, land division in Government ownership, North Kohala district, Hawaii.

Kalalau, short stream, Napali section, Hanalei district, Kauai; flows northward into sea through the deep and narrow canyon of the same name.

Kalamaula, large land division in Government ownership, south central Molokai.

Kalaoa, very small stream on lower eastern slope of Mauna Kea, Hawaii, entering the sea north of Papaikou.

Kalapaki, land division, Lihue district, Kauai.

Kalapana, village, Puna district, Hawaii.

Kalauao, land division, Ewa district, Oahu.

Kalauao, small stream, Ewa district, Oahu; rises in Koolau Mountains; flows southwestward into East Loch of Pearl Harbor.

Kalaupapa, land division in Government ownership, northern Molokai.

Kalaupapa, landing, town, and post office of leper settlement, northern Molokai; population of settlement, about 1,000; lepers are cared for by the Government.

Kalawao, county in Territory of Hawaii, including only the leper settlement on the peninsula, north coast of Molokai; population, about 1,000.

Kalawao, land division in Government ownership, northern Molokai.

Kalehuahakihaki, peak in Waimea River basin, Kauai; elevation, 3,548 feet.

Kalena, peak, Waianae Range, West Oahu; elevation, 3,507 feet.

Kalepa, ridge in eastern Kauai near the sea; elevation, 700 feet.

Kaliali, land division in Makawao and Wailuku districts, Maui.

Kalihi, land division, Honolulu district, Oahu.

Kalihi, shallow arm of the ocean on south coast of Oahu.

Kalihi, stream, Honolulu district, Oahu; rises in Koolau Mountains; flows southwestward into Kalihi Inlet; water used for taro irrigation.

Kalihi, western section of Honolulu City, Oahu.

Kalihikai, land division, Hanalei district, Kauai.

Kalihiwai, bay at mouth of Kalihiwai Stream, North Kauai.

Kalihiwai, large land division, Hanalei district, Kauai.

Kalihiwai, large stream, Hanalei district, Kauai; rises on western slope of Pueo Peak; flows northward into Kalihiwai Bay; has few tributaries; water used for rice irrigation.

Kalihiwai, village and landing on Kalihiwai Bay, Hanalei district, Kauai.

Kaloko, land division, North Kona district, Hawaii.

Kaluakoi, large land division, western Molokai.

Kaluanui, ditch, east Maui; heads in Opana Stream, well up the mountain slope; extends westward across country to junction with New Hamakua ditch above Hamakuapoko.

Kaluanui, land division, Koolauloa district, Oahu.

Kaluanui, stream, Koolauloa district, Oahu; rises in Koolau Mountains; flows northeastward into sea; water used for irrigation.

Kama, auwai, or old Hawaiian ditch, diverting water from south side of Iao Stream, west Maui, for irrigation.

Kamaio, land division, southern Molokai.

Kamakou, peak at the head of Pelekunu and Wailau gulches, Molokai; elevation, 4,958 feet.

Kamalomalo, land division in Government ownership, Kawaihau district, Kauai.

Kamananui, ditch diverting water from north side Anahulu Stream, Oahu, for cane irrigation.

Kamananui, large land division, Waialua district, Oahu.

Kamaoa, land division in Government ownership, Kau district, Hawaii.

Kamaole, large land division, Makawao district, Maui.

Kamenehune, ditch, Waimea district, Kauai; diverts water from the west side of Waimea River for taro irrigation.

Kamilolo, land division in Government ownership, south-central Molokai.
Kamoamoa, land division, Puna district, Hawaii.
Kamoku, land division in Government ownership, Hamakua district, Hawaii.
Kamooloa, ditch, Koloa district, Kauai; diverts water from the south side of Kamooloa Stream (tributary to Huleia Stream) for cane irrigation.
Kamooloa, stream, Lihue district, Kauai; tributary to Huleia Stream from the north; water used for cane irrigation.
Kanaha, ditch, Lihue district, Kauai; diverts water from the south side of North Fork of Wailua River for cane irrigation.
Kanaio, large land division in Government ownership, Makawao district, Maui.
Kaneha, ditch, Kawaihau district, Kauai; diverts water from the north side of Kealia Stream for cane irrigation.
Kaneohe, land division, Koolaupoko district, Oahu.
Kaneohe, large shallow bay on east coast of Oahu; receiving drainage from Kaneohe, Heeia, Kahaluu, Waihee, Kalaea, Waiahole, and Waikane streams. This bay is full of coral growth, allowing only smallest craft to enter.
Kaneohe, stream, Koolaupoko district, Oahu; rises in Koolau Mountains; flows northeastward into Kaneohe Bay; water used for rice irrigation.
Kaneohe, village, Koolaupoko district, Oahu.
Kaohe, land division in Government ownership, Hamakua district, Hawaii.
Kaohe, very large land division in Government ownership, in Hamakua district, Hawaii; includes summit of Mauna Kea and land westward to summit of Mauna Loa.
Kaoheiki, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea north of Waikaumalo Stream.
Kaonoulu, large land division, Wailuku and Makawao districts, Maui.
Kapaa, large land division in Government ownership, Kawaihau district, Kauai.
Kapaa, stream, Kawaihau district, Kauai; rises on eastern slope of Kapehuala Peak; flows eastward into sea; receives flow of Kealia Stream from the north; water used for cane irrigation.
Kapaa, village of homesteaders, Kawaihau district, Kauai.
Kapaakea, land division in Government ownership, south-central Molokai.
Kapaalalaea, small stream, Makawao district, Maui; rises on northern slope of Haleakala; flows northward into sea east of Halehaku Gulch; crossed by four of East Maui ditches.
Kapaau, village, North Kohala district, Hawaii.
Kapahehe, small stream on lower eastern slope of Mauna Kea, Hawaii, entering the sea north of Honomu post office.
Kapahi, ditch, Kawaihau district, Kauai; diverts water from the south side of Kapaa Stream for cane irrigation.
Kapahulu, land division, Honolulu district, Oahu.
Kapaia, village, Lihue district, Kauai.
Kapalama, land division, Honolulu district, Oahu.
Kapalama, section of Honolulu City, Oahu; settled mainly by the poorer classes.
Kapalaoa, peak on main divide east of Hanapepe Falls and west of Kilohana Crater, Kauai; elevation, 3,436 feet.
Kapapala, very large land division in Government ownership, Kau district, Hawaii.
Kapeha, small stream on lower eastern slope of Mauna Kea, Hawaii, entering the sea just north of Pepeekeo post office.
Kapehu, stream on lower eastern slope of Mauna Kea, Hawaii, entering sea just north of Maulua Gulch.
Kapehu, stream, South Hilo district, Hawaii; rises on southeastern slope of Mauna Kea; flows southeastward into Wailuku Stream from the north.
Kapehuala, peak on Kapaa-Kalihiwai divide, Kauai; elevation, 3,130 feet.

Kapoho, land division, Puna district, Hawaii.

Kapoho, village, Puna district, Hawaii.

Kapua, land division, South Kona district, Hawaii.

Kapue, stream, South Hilo district, Hawaii; rises on eastern slope of Mauna Kea; flows southeastward into sea at Papaikou.

Kau, desert section in Kapapala land division, Kau district, Hawaii, south of Kilauea Volcano.

Kau, district, Hawaii County; political subdivision in southern Hawaii; population (1910), 4,078.

Kauai, channel between Oahu and Kauai islands; width, 63 sea miles; also called Kaieiewaho Channel.

Kauai, county in Territory of Hawaii at northwest end of main group; includes Kauai and Niihau islands and a few small islets; population (1910), 23,952.

Kauai, island at northwest end of main group, 98 sea miles from Honolulu; single mountain, highest point, 5,170 feet; nearly circular, 25 to 30 miles across; area, 547 square miles; population (1910), 23,744; called the "Garden Island."

Kauaikanana, small stream, upper Waimea basin, Kauai; tributary to Poomau River from the north.

Kauaula, ditch, diverting water from north side of Kauaula Stream, West Maui, for cane irrigation.

Kauaula, stream, Lahaina district, Maui; rises on western slope of West Maui; flows westward into sea; water diverted through Piilani, Kauaula, and other ditches for cane irrigation.

Kau-Hilo, long ditch proposed for taking water from Hilo district around by the volcano into Kau district for irrigation; approximate length, 100 miles; estimated cost, $3,500,000.

Kauhola, prominent point on Kohala coast, Hawaii.

Kauhuuhuulu, land division, Kau district, Hawaii.

Kauiki Head, prominent point, on east coast of East Maui, south of Hana Bay.

Kaukonahua, large stream, Waialua district, Oahu; formed by junction of North and South forks of Kaukonahua Stream; flows northwestward into Kaiaka Bay; receives several small tributaries from Waianae Mountains from the west and Poamoho Stream near its mouth from the east; water used for cane irrigation.

Kaukonahua, North Fork, stream, Waialua district, Oahu; rises in central Koolau Mountains; flows southwestward, joining South Fork of Kaukonahua Stream to form Kaukonahua Stream; water stored in Wahiawa reservoir for irrigation.

Kaukonahua, South Fork, stream, Waialua district, Oahu; rises in central Koolau Mountains; flows westward, joining North Fork of Kaukonahua Stream to form Kaukonahua Stream; water stored in Wahiawa reservoir for irrigation.

Kaulanamauna, land division in Government ownership, South Kona district, Hawaii.

Kaunakakai, harbor and landing, on south-central coast of Molokai.

Kaunakakai, large land division, south-central Molokai.

Kaunamano, land division, Kau district, Hawaii.

Kaunuohua, peak at head of Pelekunu Gulch, Molokai; elevation, 4,535 feet.

Kaunuohua, ridge forming northern boundary of Waimea Basin, Kauai; highest point, Pihea Peak; elevation, 4,150 feet.

Kaupo, name of old district on southern slope of Haleakala, East Maui; now included in Hana district.

Kaupo, gap in the southeastern end of Haleakala Crater, West Maui, through which the last flow from the crater passed southward.

Kaupo, village, post office, and landing; on south coast of East Maui.

Kaupulehu, large land division, North Kona district, Hawaii.

Kawaihae, bay, South Kohala coast, Hawaii.

Kawaihae, large land division, partly in Government ownership, South Kohala district, Hawaii.

Kawaihae, village, post office, and landing, South Kohala district, Hawaii.

Kawaihapai, land division, Waialua district, Oahu.

Kawaihau, district, Kauai County; political subdivision in northeastern Kauai; population (1910), 2,580.

Kawaikini, peak south of Waialeale Peak, Kauai; elevation, 5,170 feet; highest point on Kauai.

Kawaikoi, stream, upper Waimea Basin, Kauai; rises in Alakai Swamp; flows southwestward to Poomau River (tributary to Waimea River).

Kawailoa, land division, Waialua district, Oahu.

Kawainui, principal tributary of Waipio River, Hamakua district, Hawaii; rises on northeastern slope of Kohala Mountains.

Kawainui, stream, South Hilo district, Hawaii; rises on upper eastern slope of Mauna Kea; flows eastward into sea, south of Pepeekeo.

Kawainui, swamp in Kailua Stream basin, East Oahu; draining into Kailua Bay.

Kawaipapa, deep gulch near Hana, East Maui.

Kawaipapa, large land division in Government ownership; Hana district, Maui.

Kawalii, small stream in large deep gulch on eastern slope of Mauna Kea, Hilo district, Hawaii; most northern permanent stream running continuously in Hilo district, south of Waipio Stream.

Kawela, large land division, south central Molokai.

Kawi, small stream, Lihue district, Kauai; tributary to North Fork Wailua River from the north.

Keaalau, stream, South Hilo district, Hawaii; rises on eastern slope of Mauna Kea; flows northeastward into sea.

Keaau, land division in Government ownership, Waianae district, Oahu.

Keaau, large land division, Puna district, Hawaii.

Keaau (Nine Miles), village, near Olaa Sugar Mill, several miles south of Hilo, Hawaii.

Keahalaka, land division, Puna district, Hawaii.

Keahole, most western point of Hawaii.

Keahua, small stream, Lihue district, Kauai; tributary to North Fork of Wailua River from the north.

Keahuolu, land division, North Kona district, Hawaii.

Kealaikahiki, channel between Lanai and Kahoolawe Islands; width, 16 sea miles.

Kealakekua, historic bay, South Kona coast, Hawaii.

Kealakekua, land division, South Kona district, Hawaii.

Kealakekua, village and post office near Kealakekua Bay, North Kona district, Hawaii.

Kealia, land division, South Kona district, Hawaii.

Kealia, large land division, Kawaihau district, Kauai.

Kealia, stream, Kawaihau district, Kauai; rises on eastern slope of Pueo Peak; flows eastward, entering Kapaa River from the north; water used for cane irrigation and power.

Kealia, village, post office, and landing, Kawaihau district, Kauai; site of Makee's Sugar Co.'s mill.

Keanae, landing, village, and post office, on north coast of East Maui.

Keanae, large land division in Government ownership, Hana district, Maui.

Keanae, large stream, Hana district, Maui; formed by East and West branches; rises high up on northeastern slope of Haleakala; flows northeastward into sea near Keanae village; supplies water to Koolau ditch.

Keaoopu, small tributary to Anahola Stream from the north, Kawaihau district, Kauai.

Keauhou, large land division, including larger part of Kilauea Crater, Kau district, Hawaii.

Keauhou, small bay, North Kona coast, Hawaii.

Keauhou, very large land division, in North and South Kona districts, Hawaii.

Keauhou, village and post office, North Kona district, Hawaii.

Keei, land division, South Kona district, Hawaii.

Kehana, bay at mouth of Kahana Stream, East Oahu.

Kekaha, ditch, Waimea district, Kauai; diverts water from the east side of Waimea River for cane irrigation on the west side.

Kekaha, village and post office, Waimea district, Kauai; site of Kekaha Sugar Co.'s mill.

Kelana, ditch diverting water from north side of Iao Stream, West Maui, for cane irrigation.

Keokea, large land division in Government ownership, Makawao district, Maui.

Keokea, point on south side of Hilo Bay, Hawaii.

Kiaiakua, small stream, Hanalei district, Kauai; flows northward into sea.

Kihalani, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea north of Papaaloa.

Kihei, village, post office, and landing on west coast of East Maui, south of Kahului Harbor.

Kiholo, bay, north Kona coast, Hawaii.

Kikola, small tributary to Honolii Stream, near Hilo, Hawaii.

Kilau, very small stream on eastern slope of Mauna Kea, Hawaii, entering sea south of Laupahoehoe Gulch.

Kilauea, crater on the southeastern slope of Mauna Loa, Hawaii; elevation, nearly 4,000 feet; largest active crater in the world; area, 4.14 square miles; circumference, 7.85 miles; extreme width, 1.95 miles; extreme length, 2.93 miles; contains the Pit, Halemaumau, with its lake of fire; one of the great natural wonders of the world, which will be included in the proposed Kilauea National Park.

Kilauea, large land division, Hanalei district, Kauai.

Kilauea, small bay at mouth of Kilauea Stream, northeast Kauai.

Kilauea, stream, Hanalei district, Kauai; rises on northern slope of Mount Namahana; flows northward into Kilauea Bay; water used for irrigating cane.

Kilauea, village and post office, Hanalei district, Kauai; site of Kilauea Sugar Plantation Co.'s mill.

Kilohana, point on northern edge of Alakai Swamp overlooking Wainiha Canyon, Kauai; elevation, 4,023 feet.

Kilohana, tufa crater, Lihue district, Kauai; elevation, 1,100 feet.

Kiomakaa, land division partly in Government ownership, Kau district, Hawaii.

Kipahoehoe, land division in Government ownership, South Kona district, Hawaii.

Kipahulu, landing, village, and post office, on south coast of East Maui; site of Kipahulu Sugar Co.'s mill.

Kipahulu, name of old district on southeastern slope of Haleakala, East Maui; now included in Hana district.

Kipapa, ditch, diverting freshet water from east side of Kipapa Stream, Oahu, for cane irrigation.

Kipapa, stream, Ewa district, Oahu; rises in Koolau Mountains; flows southward joining Waikakalaua Stream to form Waipahu Stream; freshet water used for cane irrigation.

Kipu, land division, Lihue district, Kauai.

Koaie, stream, north-central Waimea basin, Kauai; rises on western slope of main divide; flows southwestward to Waimea River through a deep, picturesque canyon which extends nearly to its source.

Kohala, ditch diverting water from the west side of Awini and Honokane streams, Kohala district, Hawaii, for cane irrigation.

Kohala, mountain range, northern Hawaii; deeply eroded on northern slopes; highest elevation, 5,489 feet.

Kohala, village and post office, North Kohala district, Hawaii.

Kohala, N., district, Hawaii County; political subdivision in northern Hawaii; population (1910), 5,398.

Kohala, S., district, Hawaii County; political subdivision in northwestern Hawaii; population (1910), 922.

Kohala (upper), ditch diverting water at a high elevation from Honokane Stream, Kohala district, Hawaii, for cane irrigation.

Koheake, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea just north of Maulua Gulch.

Koholalele, freight landing, Hamakua district, Hawaii.

Koholalele, land division, Hamakua district, Hawaii.

Koiawe, tributary of Waipio River, Hamakua district, Hawaii; rises on northern slope of Kohala Mountains, entering Waipio River from the west.

Kokee, small stream, upper Waimea Basin, Kauai; tributary to Waimea River from the north.

Koko Head, two prominent tufa craters, southeast Oahu; elevation of higher, 1,205 feet; elevation of lower, 644 feet.

Kolea, small stream, Hana district, Maui; rises on northern slope of Haleakala; flows northeastward into sea; formed by several branches which supply water to Spreckels ditch.

Kolekole, pass in Waianae Range, West Oahu; between Leilehua Military Reservation and Lualualei Valley on the south.

Kolekole, stream, South Hilo district, Hawaii; rises on eastern slope of Mauna Kea; flows eastward into sea a short distance north of Honomu post office.

Koloa, district, Kauai County; political subdivision in southern Kauai east of Hanapepe River and south of Haupu Ridge; population (1910), 5,769.

Koloa, landing, South Kauai.

Koloa, large land division, Koloa district, Kauai.

Koloa, stream, Koloa district, Kauai; rises on southern slope of main divide; flows southward into sea.

Koloa, village and post office, Koloa district, Kauai; site of Koloa Sugar Co.'s mill.

Kona, N., district, Hawaii County; political subdivision in western Hawaii; population (1910), 3,377.

Kona, S., district, Hawaii County; political subdivision in southwestern Hawaii; population (1910), 3,191.

Konahuanui, peak, Koolau Range, East Oahu; south of Nuuanu Pali Pass; elevation, 3,105 feet.

Konohiki, small stream, Kawaihau district, Kauai; flows eastward into sea; water used for irrigation.

Koolau, ditch, East Maui; begins at weir near Kopiliula, at mouth of Nahiku ditch; extends westward across country to division weir at Alo Stream, intercepting the streams east of Honomanu Stream.

Koolau, gap in north rim of Haleakala Crater, West Maui, through which later lava streams poured into Keanae Valley.

Koolau, name of old district on northeastern slope of Haleakala, East Maui; now included in Hana district.

Koolauloa, district, in city and county of Honolulu; political subdivision in northeastern Oahu; population (1910), 3,204.

Koolaupoko, district, in city and county of Honolulu; political subdivision in windward southeastern Oahu; population (1910), 3,251.

Kopiliula, small stream, Hana district, Maui; rises on northeastern slope of Haleakala; flows northeastward into sea; supplies water to Koolau ditch.

Koukouai, small stream, Hana district, Maui; rises on southwestern slope of Haleakala; flows southeastward into sea near Kipahulu.

Kuiaha, small stream, Makawao district, Maui; rises on northwestern slope of Haleakala; flows into sea east of Maliko Gulch; crossed by four or five East Maui ditches.

Kuikuiula, small stream, Hana district, Maui; rises on southeastern slope of Haleakala; flows southeastward into sea west of Kipahulu.

Kukaiau, land division, Hamakua district, Hawaii.

Kukaiau, village, Hamakua district, Hawaii.

Kukuihaele, village, post office, and freight landing, Hamakua district, Hawaii.

Kukuipahu, land division, North Kohala district, Hawaii.

Kulanakii (Papaa), stream on lower eastern slope of Mauna Kea, Hawaii; entering sea near Maulua Gulch.

Kula, name of an old district on western slope of Haleakala, East Maui; now included in Makawao district.

Kula pipe line, domestic water-supply system for upper, western, and southern slopes of Haleakala, Maui; intake at Puohakamoa Stream at about 4,500 feet elevation; length of main line, 25 to 30 miles.

Kuliouou, land division, partly in Government ownership, Honolulu district, Oahu.

Kumukahi, cape, extreme eastern point of Hawaii.

Kumukahi, channel between Kauai and Niihau Islands; width, 15 sea miles.

Kumunuiakea, small stream on lower southeastern slope of Mauna Kea, entering the sea near Papaikou, Hawaii.

Kuna, ditch, Hanelei district, Kauai; diverts water from the east side of Hanalei River for rice irrigation.

Kurtistown (Olaa), village and post office, Puna district, Hawaii.

Laeloa, or Barbers Point, low flat area at southwest corner of Oahu.

Lahaina, district, Maui County; political subdivision in leeward West Maui, including Lanai Island; population (1910), 4,918.

Lahaina, open roadstead and landing off west coast of West Maui.

Lahaina, village and post office, on west coast of West Maui; formerly the old capital of the Hawaiian Kingdom; site of Pioneer Mill Co.'s sugar factory.

Lahainaluna, stream, Lahaina district, Maui; rises on western slope of West Maui; flows westward into Kahoma Stream from the south; water diverted for municipal and irrigation purposes.

Laie, land division in Koolauloa district, Oahu.

Laie, small bay on northeast coast of Oahu.

Laie, village and post office, Koolauloa district, Oahu.

Lalakea, land division, Hamakua district, Hawaii.

Lalamilo, land division in Government ownership, South Kohala district, Hawaii.

Lamaloloa, land division, partly in Government ownership, North Kohala district, Hawaii.

Lanai, island in private ownership south of Molokai, west of Maui, more than 50 sea miles southeast of Honolulu; 18 miles long, 10 miles wide; highest point, 3,400 feet; area, 139 square miles; population (1910), 131; included in Lahaina district, Maui County.

Lanihuli, peak, Koolau Range, East Oahu; north of Nuuanu Pali Pali Pass; elevation, 2,781 feet.

Launiupoko, ditch diverting water from north side of Launiupoko Stream, West Maui, for cane irrigation.

Launiupoko, large land division in Government ownership, Lahaina district, Maui.

Launiupoko, stream, Lahaina district, Maui; rises on southwestern slope of West Maui; flows southwestward into sea; water diverted through several ditches for cane irrigation.

Laupahoehoe, land division in Government ownership, Hamakua district, Hawaii.

Laupahoehoe, large land division, partly in Government ownership, North Hilo district, Hawaii.

Laupahoehoe, small stream on eastern slope of Mauna Kea, Hawaii; entering sea through a deep gulch of the same name at Laupahoehoe.

Laupahoehoe, village, post office, and passenger landing, North Hilo district, Hawaii.

Lawai, land division, Koloa district, Kauai.

Lawai, stream, Koloa district, Kauai; flows southward into sea.

Lawai, village, Koloa district, Kauai; site of pineapple cannery.

Leahi. (See Diamond Head.)

Leleiwi, point east of Hilo Bay, Hawaii.

Lepeuli, small land division, Hanalei district, Kauai.

Lihue, district, Kauai County; political subdivision in southeastern Kauai; population (1910), 4,951.

Lihue, ditch, Lihue district, Kauai; diverts water from south side of Waiahi Stream (tributary to South Fork of Wailua River) for cane irrigation.

Lihue, town and post office, Lihue district, Kauai; county seat of Kauai County.

Limaluli, short stream, Hanalei district, Kauai; flows northward into sea.

Lowrie, ditch, East Maui; heads in Nailülihaele Stream, near Kailua at about the same elevation as Haiku ditch; extends westward across country on a gentle grade to cane lands around Hamakuapoko, intercepting all streams on the way; length, about 22 miles.

Lualailua, large land division in Government ownership, Hana district, Maui.

Lualualei, land division partly in Government ownership, Waianae district, Oahu.

Lumahai, large land division, Hanalei district, Kauai.

Lumahai, large stream, Hanalei district, Kauai; rises on northern slope of Waialeale; flows northward into sea; receives numerous short tributaries from east and west; water used for irrigating rice and taro in lower part of valley.

Maalaea, bay, on south side of peninsula, Maui.

Mahaulepu, land division, Koloa district, Kauai.

Mahinauli, gulch, Waimea district, Kauai.

Mahukona, village, post office, and landing, North Kohala district, Hawaii.

Mailepai, small stream, Lahaina district, Maui; rises on northwestern slope of West Maui; flows northwestward, only flood waters reaching the sea.

Maili, large stream on southeastern slope of Mauna Kea, Hawaii, tributary to Honolii Stream from the south.

Makaha, land division, Waianae district, Oahu.

Makahanaloa, long land division, South Hilo district, Hawaii.

Makaka, land division, partly in Government ownership, Kau district, Hawaii.

Makanalua, land division in Government ownership, northern Molokai.

Makapala, village, North Kohala district, Hawaii.

Makapipi, stream, Hana district, Maui; rises on eastern slope of Haleakala; flows northeastward into sea near Nahiku; most eastern stream supplying water to the East Maui ditch system.

Makapuu, point at southeast end of Oahu; site of lighthouse.

Makawao, district, Maui County; political subdivision in central East Maui, including Kahoolawe Island; population (1910), 8,857.

Makawao, land division, Makawao district, Maui.

Makawao, village and post office on northwestern slope of Haleakala, Maui.

Makaweli, large land division, Waimea district, Kauai.

Makaweli, short river in southern Waimea basin, Kauai; formed by Olokele and Makuone streams; flows southwestward, entering Waimea River from the east about a mile from the sea; water used for rice irrigation.

Makaweli, village and post office, Waimea district, Kauai; site of Hawaiian Sugar Co.'s mill.

Makea, small stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea north of Pepeekeo post office.

Makena, landing, village, and post office, on west coast of East Maui.

Makiki, land division in Government ownership, Honolulu district, Oahu.

Makiki, residential section, and valley back of, Honolulu, Oahu.

Makiki, small stream, Honolulu district, Oahu; rises on the southern slope of Tantalus Peak, Koolau Range; flows southward into sea; one source of Honolulu water supply.

Makoewai, small stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea north of Pepeekeo post office.

Makua, land division in Government ownership, Waianae district, Oahu.

Makuone, stream, central Waimea basin, Kauai; rises on western slope of Waialeale; flows southwestward to junction with Olokele River to form Makaweli River.

Malaekahana, land division, Koolauloa district, Oahu.

Maliko, stream, Makawao district, Maui, rises on northwestern slope of Haleakala; flows northwestward through a deep gulch into sea; crossed by five ditches, to which it contributes water, especially at flood stages.

Mamolokama, peak south of Hanalei Bay, Kauai.

Mana, low, swampy area at west end of Kauai.

Manana, land division, Ewa district, Oahu.

Manawaiiao, stream, Makawao district, Maui; rises on northwestern slope of Haleakala; flows northwestward into sea east of Maliko Gulch; crossed by four or five East Maui ditches.

Manawainui, small stream, Hana district, Maui; rises on southern slope of Haleakala; flows southward into sea west of Kipahulu.

Maniania, ditch diverting water from north side of Iao Stream, West Maui, for cane irrigation on both sides of Iao Valley.

Manoa, important stream, Honolulu district, Oahu; rises on southern slope of Konahuanui Peak, Koolau Range; flows southward into sea; receives several small tributaries; water used for taro irrigation.

Manoa, land division, Honolulu district, Oahu.

Manoa, residential section of Honolulu, in Manoa Valley, Oahu.

Manoloa, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea south of Maulua Gulch.

Manowaialee, land division, partly in Government ownership, Hamakua district, Hawaii.

Manowaiopae, stream, South Hilo district, Hawaii; entering sea south of Laupahoehoe Gulch.

Manuahi, stream, Waimea district, Kauai; tributary to Waimea River from the west.

Manuka, large land division in Government ownership, Kau district, Hawaii.

Mapulehu, land division, southeastern Molokai.

Maui, county in Territory of Hawaii including the islands of Maui, Molokai, Lanai, and Kahoolawe; population (1910), 30,547.

Maui, island southeast of Oahu and 72 sea miles from Honolulu; consists of two high mountains connected by low peninsula 8 miles in width; highest point, 10,032 feet, in East Maui; irregular in shape, 48 miles long, 30 miles wide; area, 728 square miles; population (1910), 28,623; called the "Valley Isle."

Maulua, large land division, North Hilo district, Hawaii.

Maulua, small bay at mouth of Maulua Gulch, East Hawaii.

Maulua, stream, South Hilo district, Hawaii; rises on eastern slope of Mauna Kea; flows northeastward through a very deep gulch into sea.

Mauna Kea, mountain in northeastern Hawaii; elevation, 13,825 feet, highest island mountain in the world; does not culminate in a single prominent peak, but has a summit platform upon which rise many huge cinder cones.

Mauna Loa, highest peak, west Molokai; elevation, 1,382 feet.

Mauna Loa, mountain, south-central Hawaii; elevation, 13,675 feet; unique in having a crater, Mokuaweoweo—the second largest active volcano in the world—sunk in its summit platform.

Maunalua, bay between Diamond and Koko heads, on south coast of Oahu.

Maunalua, large land division, Honolulu district, Oahu.

Maunawili, land division, Koolaupoko district, Oahu.

McGregors, landing on Maalaea Bay, south side of peninsula, Maui.

Milolii, gulch, Napali section, Waimea district, Kauai.

Milolii, land section in Government ownership, western Kauai.

Moanualua, land division, Honolulu district, Oahu.

Moanalua, stream, Honolulu district, Oahu; rises in Koolau Mountains; flows southwestward into Kalihi Inlet; water used for rice irrigation.

Moanalulu, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea south of Papaaloa.

Moaula, land division partly in Government ownership, Kau district, Hawaii.

Mohihi, stream, upper Waimea Basin, Kauai; tributary from the east to Poomau River (tributary to Waimea River).

Mokapu, point, or headland, off Kaneohe Bay, East Oahu.

Mokihana, small stream, south-central Waimea Basin, Kauai; rises east of Kalehuahakihaki Peak; flows southwestward to Waimea River.

Mokuaweoweo, crater on the summit of Mauna Loa, Hawaii; elevation, about 13,500 feet; second largest active crater in the world; area, 3.70 square miles; circumference, 9.47 miles; length, 3.7 miles; width, 1.74 miles; intermittently active, the activity usually lasting only a few days, when the lava forces its way through the side of the mountain, in a lava flow, after which the eruption in the crater ceases.

Mokuleia, large land division partly in Government ownership, Waialua district, Oahu.

Moloaa, land division partly in Government ownership, Kawaihau district, Kauai.

Moloaa, small stream, Kawaihau district, Kauai; flows northeastward into Moloaa Bay.

Molokai, district, Maui County; political subdivision including Molokai Island; population (1910), 1,791.

Molokai, island southeast of Oahu, 52 sea miles from Honolulu; lies east and west, 40 miles long, 9 miles wide; highest point, 4,958 feet; area, 261 square miles; population (1910), 1,791.

Mountain View, village and post office, Puna district, Hawaii.

Muliwai, land division in Government ownership, Hamakua district, Hawaii.

Naalehu, village and post office, Kau district, Hawaii.

Nahiku, ditch extension, East Maui; heads in Makapipi Gulch, above Nahiku; extends westward across country to weir near Kopiliula, where it terminates at the eastern end of Koolau ditch.

Nahiku, landing, village, and post office, on north coast of East Maui; center of rubber district.

Naholoku, large land division, Hana district, Maui.

Nailiilihaele, large stream, Makawao district, Maui; rises high up on northern slope of Haleakala; flows northeastward into sea; supplies water to three East Maui ditches.

Naiwa, large land division, central Molokai.

Namahana, peak at head of Anahola Stream, Kauai; elevation, 2,650 feet.

Nanakuli, land division, Waianae district, Oahu.

Nanue, small stream on lower eastern slope of Mauna Kea, Hawaii, entering the sea just north of Honohina.

Napali, name of old district in Government ownership in northwestern Kauai, now included in Hanalei district.

Napoopoo, village and landing on Kealakekua Bay, South Kona district, Hawaii.

Nawiliwili, bay at mouths of Huleia and Nawiliwili streams, southeast Kauai; selected for improvement as Kauai's harbor.

Nawiliwili, land division, Lihue district, Kauai.

Nawiliwili, small stream, Lihue district, Kauai; rises on eastern slope of Kilohana Crater; flows southeastward into Nawiliwili Bay; water used for rice and cane irrigation.

Nawiliwili, village and landing for freight and passengers, on Nawiliwili Bay, Kauai; nearest landing from Honolulu.

Nienie, land division in Government ownership, Hamakua district, Hawaii.

Niihau, island southwest of Kauai in private ownership; area, 73 square miles; population (1910), 208; included in Waimea district, Kauai County.

Nine Miles (Keaau), village near Olaa sugar mill, several miles south of Hilo, Hawaii.

Ninole, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea south of Maulua Gulch.

Niu, land division, Honolulu district, Oahu.

Niumalu, land division, Lihue district, Kauai.

Nohili, point on west coast of Kauai.

Nuaailua, small stream, Hana district, Maui; flows northeastward into sea; supplies water to Koolau ditch through its branches.

Nuu, large land division, Hana district, Maui.

Nuuanu, important stream, Honolulu district, Oahu; rises at Nuuanu Pali pass, Koolau Range; flows southwestward through Nuuanu Valley into Honolulu Harbor; receives the flow of Pauoa Stream near its mouth; water used as part of Honolulu city water supply and for taro irrigation.

Nuuanu, land division partly in Government ownership, Honolulu district, Oahu.

Nuuanu, old residential section of Honolulu, at the lower end of Nuuanu Valley, Oahu.

Nuuanu Pali, pass and cliff, Koolau Range, East Oahu; elevation, 1,207 feet; one of the historic and scenic places of Honolulu, only 6 miles distant.

Nuulolo, gulch, Napali section, Waimea district, Kauai.

Oahu, island near center of main group, Lat. 21° 30′ N., Long. 158° W.; 98 sea miles southeast of Kauai and 134 sea miles northwest of Hawaii; consists of two mountain ranges, Koolau and Waianae, with a tableland between; highest point, Kaala, 4,030 feet; roughly quadrilateral; length, 45 miles; width, 24 miles; area, 598 square miles; population (1910), 81,993.

Oahu-Koolau, ditch, proposed for bringing water from the windward side of Oahu through the main Koolau Range for cane irrigation north of Pearl Harbor; approximate length, 15 miles; length of main tunnel, about 14,000 feet; estimated cost, $1,250,000.

Oanui, stream, Makawao district, Maui; rises on northern slope of Haleakala; flows northeastward into Kailua Stream from the west; supplies water to Hamakua ditch.

Oheo, small stream, Hana district, Maui; rises on southeastern slope of Haleakala; flows southeastward into sea near Kipahulu.

Okole, very small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea near Maulua Gulch.

Olaa, large land division, Puna district, Hawaii.

Olaa (Kurtistown), village and post office, Puna district, Hawaii.

Olohena, land division partly in Government ownership, Kawaihau district, Kauai.
Olokele, ditch, Waimea district, Kauai; diverts water from the south side of Olokele Stream for cane irrigation.
Olokele, river, eastern Waimea basin, Kauai; rises on western slope of Waialeale; flows southwestward to junction with Makuone to form Makaweli River; receives the flow of Kahana Stream from the north; water diverted through Olokele ditch for cane irrigation.
Olowalu, land and village on southwest coast of West Maui.
Olowalu, large land division in Government ownership, Lahaina district, Maui.
Olowalu, stream, Lahaina district, Maui; rises in southern slope of West Maui; flows southwestward into sea; water diverted through several ditches for cane irrigation.
Olympus (or Awawaloa), peak, Koolau Range, East Oahu; at the head of Manoa Valley; elevation, 2,447 feet.
Onomea, small bay, South Hilo coast, Hawaii.
Onomea, small stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea south of Onomea arch.
Onomea, village on Onomea Bay, South Hilo district, Hawaii.
Ookala, village, post office, and freight landing, North Hilo district, Hawaii.
Oopuola, small stream on boundary between Makawao and Hana districts, East Maui; flows northeastward into sea; contributes water to two ditches.
Opaeula, ditch diverting water from north side Opaeula Stream, Oahu, for cane irrigation.
Opaeula, stream, Waialua district, Oahu; rises in northern Koolau Mountains; flows northwestward into Kaiaka Bay; water used for cane irrigation.
Opaikaa, stream, Lihue district, Kauai; tributary to Wailua River from the north.
Opana, land division, Makawao district, Maui.
Opana, stream, Makawao district, Maui; rises on the northern slope of Haleakala; flows northwestward, entering Halehaku Stream from the west; contributes water to the Hamakua ditches.
Opea, stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea just south of Honohina.
Paa, land division, Koloa district, Kauai.
Paakea, stream, Hana district, Maui; rises on eastern slope of Haleakala; flows northeastward into sea; supplies water to Koolau ditch.
Paalaa, land division, Waialua district, Oahu.
Paauhau, very large land division, Hamakua district, Hawaii.
Paauhau, village, post office, and freight landing, Hamakua district, Hawaii.
Paauilo, village, Hamakua district, Hawaii.
Paeahu, large land division, Makawao district, Maui.
Pahala, village and post office, Kau district, Hawaii.
Pahoa, village, Puna district, Hawaii.
Paia, town and post office 10 miles east of Kahului Harbor, Maui.
Palaau, large land division in Government ownership, northern Moloka'
Palemanu, point south of Kealakekua Bay, west coast of Hawaii.
Palikea, peak, Waianae Range, West Oahu; elevation, 3,111 feet.
Pailolo, channel between Maui and Molokai Islands; width, 8 sea miles.
Palolo, ditch diverting water from north side of Waikapu Stream, West Maui, for cane irrigation.
Palolo, land division, Honolulu district, Oahu.
Palolo, short stream, Honolulu district, Oahu; rises on southern slope of Olympus, Koolau Range; flows southward into sea; formed by junction of Waiamao and Pukele streams; water used principally for taro irrigation.
Panaunui, land division in Puna district, Hawaii.
Papa, village, South Kona district, Hawaii.

Papaa, land division partly in Government ownership, Kawaihau district, Kauai.

Papaa, small stream, Kawaihau district, Kauai; flows eastward into Papaa Bay.

Papaa (Kulanakii), stream on lower eastern slope of Mauna Kea, Hawaii; entering sea near Maulua Gulch.

Papaaea, small stream, Makawao district, Maui; flows northeastward into reservoir near Kailua.

Papaaloa, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea south of Papaaloa.

Papaaloa, village, post office, and freight landing, North Hilo district, Hawaii.

Papaikou, large land division, South Hilo district, Hawaii.

Papaikou, village and freight landing, South Hilo district, Hawaii.

Paukaa, land division, South Hilo district, Hawaii.

Paumalu, land division in Koolauloa district, Oahu.

Pauoa, small stream, Honolulu district, Oahu; rises in Koolau Mountains; flows southwestward into Nuuanu Stream from the east; water used for taro irrigation.

Pauwela, land division, Makawao district, Maui.

Pauwela, village near Haiku, Makawao district, Maui.

Peahi, village just west of Halehaku Gulch, Maui.

Pearl City, town and post office near East Loch, Pearl Harbor, Oahu.

Pearl Harbor, large landlocked arm of the Pacific Ocean, on south coast of Oahu, about 6 miles west of Honolulu; consists of East, Middle, and West Lochs; principal affluents, Halawa, Kalauao, Waimalu, Waiawa, and Waipahu streams, also numerous springs near sea level; contains Fords Island. Site of United States naval base and dry dock, now under construction.

Pelekunu, large land division, partly in Government ownership, northern Molokai.

Pelekunu, short stream, northern Molokai; rises at 4,500 feet elevation; flows northward into sea through Pelekunu Gulch, which is very deep; water used for taro irrigation; accessible only from the sea.

Pepeekeo, small stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea just south of Pepeekeo post office.

Pepeekeo, village, post office, and freight landing, South Hilo district, Hawaii.

Piha, land division in Government ownership, North Hilo district, Hawaii.

Piilani, ditch diverting water from north side of Kauaula Stream, West Maui, for cane irrigation.

Piihonua, very large land division in Government ownership, South Hilo district, Hawaii.

Pilaa, land division, Hanalei district, Kauai.

Poamoho, stream, Waialua district, Oahu; rises in central Koolau Mountains; flows northwestward into Kaukonahua Stream from the east; water used for irrigation.

Pohaku Hanalei, peak on northeastern slope of Mauna Loa, Hawaii; elevation, 12,310 feet.

Pohakunanaka, small stream on lower southeastern slope of Mauna Kea, entering the sea near Hilo, Hawaii.

Pohakupili, peak on Kealia-Kapaa divide, Kauai; elevation, 2,589 feet.

Pohakupuka, stream on lower eastern slope of Mauna Kea, Hawaii, entering sea near Maulua Gulch.

Pohokea, homestead section, Hamakua district, Hawaii.

Pokai, small bay at mouth of Waianae Stream, southwest Oahu.

Poliahu, peak near summit of Mauna Kea, Hawaii; elevation, 13,646 feet.

Pololu, land division in Government ownership, North Kohala district, Hawaii.

Pololu, stream, Kohala district, Hawaii; rises on northern slope of Kohala Mountains; flows northward into sea west of Honokane Gulch.

Ponahawai, land division, South Hilo district, Hawaii.

Poomau, short river, upper Waimea basin, Kauai; rises in Alakai Swamp; flows southwestward to Waimea River, its lower portion being in a deep canyon.

Poopoo, stream on lower eastern slope of Mauna Kea, Hawaii; entering sea south of Maulua Gulch.

Poowaiomahaihai, ditch, Waimea district, Kauai; diverts water from the south side of Makaweli River for taro and cane.

Puako, village and freight landing (post office, Lalamilo), on Puako Bay, South Kohala district, Hawaii.

Pukele, short stream, Honolulu district, Oahu; rises on southern slope of Kaau Crater; flows southward to junction with Waiamao Stream to form Palolo Stream.

Pukihae, stream, South Hilo district, Hawaii; rises on lower southeastern slope of Mauna Kea; flows southeastward into sea, north of Hilo.

Pukoo, harbor and landing on southeast coast of Molokai.

Pulehunui, large land division, Wailuku and Makawao districts, Maui.

Pulili, small stream on lower eastern slope of Mauna Kea, Hawaii; formed by junction of Kaleiiki and Kapena streams; enters the sea a short distance north of Honohina.

Puna, district, Hawaii County; political subdivision in eastern Hawaii; population (1910), 6,834.

Punahoa, land division, in South Hilo district, Hawaii.

Punahou, main residential section of Honolulu, adjoining grounds of Oahu College, Oahu.

Punakou, land division, southwestern Molokai.

Punaluu, land division in Koolauloa district, Oahu.

Punaluu, stream, Koolauloa district, Oahu; rises in Koolau Mountains; flows northeastward into sea; water used for irrigation.

Punaluu, village and post office, Koolauloa district, Oahu.

Punaluu, freight landing, Kau district, Hawaii.

Punaluu, land division, Kau district, Hawaii.

Punchbowl Hill, tufa crater just back of Honolulu; elevation, 498 feet.

Puohakamoa, large stream, Hana district, Maui; rises on northern slope of Haleakala; flows northeastward into sea; supplies water to Spreckels and Center ditches.

Puolo, point west of Hanapepe Bay, Kauai.

Puowaina. See Punchbowl Hill.

Pupukea, land division, Koolauloa district, Oahu.

Puu Alaea, very small stream on eastern slope of Mauna Kea, Hawaii; entering sea south of Laupahoehoe Gulch.

Puuanahulu, very large land division in Government ownership, North Kona district, Hawaii.

Puu Ehu, peak on Anahola Mountains, Kauai; elevation, 1,939 feet.

Puueo, land division, South Hilo district, Hawaii.

Puu Eu, peak on Kealia-Kalihiwai divide, Kauai; elevation, 2,747 feet.

Puu Ka Pele, peak on western edge of Waimea Canyon, Kauai; elevation, 3,657 feet.

Puukapu, large land division in Government ownership, South Kohala district, Hawaii.

Puu Kukui, summit of West Maui; elevation, 5,790 feet.

Puuloa, land division, Ewa district, Oahu, just west of entrance to Pearl Harbor.

Puuloa, village and railway station, east of Pearl Harbor.

Puu Lua, peak on western edge of Waimea Canyon, northwest of Puu Ka Pele, Kauai; elevation, 3,500 feet.

Puumakaa, land division, Kau district, Hawaii.

Puunene, town and post office, a few miles south of Kahului Harbor, Maui; site of Hawaiian Commercial & Sugar Co.'s mill, the largest in the islands.

Puu Ohia. (See Tantalus.)

Puuohua, small stream on lower eastern slope of Mauna Kea, Hawaii, entering sea south of Maulua Gulch.

Puu Olii, very small stream on lower eastern slope of Mauna Kea, Hawaii, entering sea near Maulua Gulch.

Puupehu, land division, Hanalei district, Kauai.

Puuwaawaa, large land division in Government ownership in North Kona district, Hawaii.

Puu Waawaa, peak north of Hualalai, North Kona district, Hawaii; elevation, 3,824 feet.

Round Top, hill back of Honolulu, Oahu; elevation, 1,049 feet.

Salt Lake, small lake in crater west of Honolulu, Oahu; called also Aliapaakai.

Scofield Barracks, post office and cantonment of the United States Army at Leilehua, near the center of Oahu.

Sisal, railway station, west of Ewa mill, in center of the sisal district, Ewa district, Oahu.

Spreckels ditch, diversion from Honomanu Stream, East Maui, at about 1,500 feet elevation; extends westward across country, dropping successively into the various streams and taking out again at a lower elevation until it reaches Nailiilihaele Stream at the intake of Haiku and Lowrie ditches.

Spreckels ditch, diverts water from south side of Waihee Stream, West Maui, for cane irrigation.

Spreckelsville, village, a few miles east of Kahului Harbor.

Tantalus (or Puu Ohia), hill, Koolau Range, east Oahu; northeast of Honolulu; elevation, 2,013 feet.

Ualakaa. (See Round Top.)

Uhau Iole, stream, Lihue district, Kauai; tributary to North Fork Wailua River from the north.

Ukumehame, large land division in Government ownership, Lahaina district, Maui.

Ukumehame, stream, Lahaina district, Maui; rises on southern slope of West Maui; flows southwestward into sea; water diverted through several ditches for cane irrigation.

Ulupalakua, ranch and settlement on western slope of Haleakala, Maui, near Makena.

Umauma, stream, South Hilo district, Hawaii; formed by the junction of Wailua and Haunapueo streams, rising on eastern slope of Mauna Kea, flowing northeastward into sea near Hakalau.

Upolu, extreme northern point of Hawaii.

Volcano House, hotel and post office on brink of Kilauea Crater, Hawaii; elevation, 3,971 feet.

Wahiawa, land division, Koloa district, Kauai.

Wahiawa, large land division, partly in Government ownership, Waialua district, Oahu.

Wahiawa, reservoir ditch diverting water from North and South Forks of Kaukonohua Stream, below Wahiawa Dam, Oahu, for cane irrigation.

Wahiawa, reservoir on Kaukonahua Stream, central Oahu; water used for cane irrigation.

Wahiawa, stream, Koloa district, Kauai; rises on western slope of main divide; flows southwestward into sea.

Wahiawa, village and post office on plateau in pineapple district near center of Oahu; reached by branch line of Oahu Railway from Waipahu.

Wahikuli, gulch, Lahaina district, Maui; heads on western slope of west Maui; flood waters flow westward into sea.

Wahiuli, land division in Government ownership, Lahaina district, Maui.

Waiaaka, small stream, Hana district, Maui; rises on eastern slope of Haleakala; flows northeastward into sea; supplies water to Nahiku ditch.

Waiaama, stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea north of Kawainui Stream.

Waiahi, stream, Lihue district, Kauai; tributary to South Fork Wailua River; water used for cane irrigation.

Waiahole, land division, partly in Government ownership, Koolaupoko district, Oahu.

Waiahole, stream, Koolaupoko district, Oahu; rises in central Koolau Mountains; flows southeastward into Kaneohe Bay; receives the flow of Waianu Stream from the north; water used for rice irrigation.

Waiahole, village, Koolaupoko district, Oahu.

Waiakaa, large land division in Government ownership, Wailuku and Makawao districts, Maui.

Waiakalua, small land division, Hanalei district, Kauai.

Waiakea, very large land division in Government ownership, South Hilo district, Hawaii.

Waiakea, village and suburb of Hilo, on Hilo Bay, Hawaii.

Waiakoa, post office, in Kula section, west Maui.

Waiakoali, small stream, upper Waimea Basin, Kauai; tributary to Kawaikoi Stream from the east.

Waialae, land division, Honolulu district, Oahu.

Waialae, stream in central Waimea Basin, Kauai; rises on western slope of Waialeale; flows westward and southwestward to Waimea River, with a fall of about 2,500 feet within a short distance from its mouth.

Waialeale, peak in central mountain mass of Kauai; elevation, 5,080 feet.

Waialee, land division in Government ownership, Koolauloa district, Oahu.

Waialua, district, in city and county of Honolulu; political subdivision in north-central Oahu; population (1910), 6,770.

Waialua, land division, southeastern Molokai.

Waialua, small bay at mouth of Anahula Stream, northwest Oahu.

Waialua, village and post office, Waialua district, Oahu; site of Waialua Agricultural Co.'s mill.

Waianae, district, in city and county of Honolulu; political subdivision in southwestern Oahu; population (1910), 1,958.

Waianae, land division partly in Government ownership, Waianae district, Oahu.

Waianae, stream, Waianae district, Oahu; rises on south slope of Kaala Peak, Waianae Range; flows southwestward through Waianae Valley into sea; receives several tributaries in the upper part of its course; water used for power, and cane irrigation.

Waianae, village and post office at mouth of Waianae Valley, Waianae district, Oahu; site of Waianae Co.'s mill.

Waianae Uku, large land division, Waialua district, Oahu.

Waianu, stream, Koolaupoko district, Oahu; rises in central Koolau Mountains; flows southeastward, entering Waiahole Stream from the north; water used for rice and taro irrigation.

Waiau, lake, near summit of Mauna Kea, Hawaii; elevation, 13,041 feet.

Waiau, land division, Ewa district, Oahu.

Waiawa, ditch, diverting freshet water from Waiawa Stream, Oahu, for cane irrigation.

Waiawa, large land division, Ewa district, Oahu.

Waiawa, residence of Knudsen Bros., proprietors of Waiawa Ranch, Waimea district, Kauai.

Waiawa, stream, Ewa district, Oahu; rises in Koolau Mountains; flows southwestward through Waiawa Gulch into Middle Loch of Pearl Harbor; receives flow of Manana Stream from the east; freshet water used for cane irrigation.

Waiea, land division, partly in Government ownership, South Kona district, Hawaii.

Waiehu, land division, Wailuku district, Maui.

Waiehu, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea north of Honohina.

Waiehu, stream, Wailuku district, Maui; consists of two branches North and South Waiehu streams, rising on eastern slope of West Maui, and flowing eastward into sea; water diverted from both branches for cane irrigation.

Waieli, small stream, Hana district, Maui; rises on southeastern slope of Haleakala; flows southeastward into sea.

Waieli, stream, Ewa district, Oahu; tributary to Waikakalaua Stream from the west.

Waihee, canal diverting water from south side of Waihee Stream, West Maui, for cane irrigation.

Waihee, land division, Koolaupoko district, Oahu.

Waihee, large land division, Wailuku district, Maui.

Waihee, large stream, Wailuku district, Maui; rises on northeastern slope of West Maui near the summit; flows northeastward through a deep picturesque canyon into sea; water diverted through Waihee Canal and Spreckels ditch for cane irrigation and through several other smaller ditches for taro irrigation.

Waihee, stream, Koolaupoko district, Oahu; rises in Koolau Mountains; flows eastward into Kaneohe Bay; water used for rice irrigation.

Waihee, village and plantation camp, near mouth of Waihee Stream, East Maui.

Waikakalaua, ditch, diverting water from south side of Waikakalaua Stream, Oahu, for cane irrigation.

Waikakalaua, stream, Ewa district, Oahu; rises in Koolau Mountains; flows southward joining Kipapa Stream from the west to form Waipahu Stream; freshet water used for cane irrigation.

Waikamoi, stream, Hana district, Maui; rises on northern slope of Haleakala; flows northeastward into sea, contributing water to two ditches; tributary, Alo Stream.

Waikane, land division, Koolaupoko district, Oahu.

Waikane, stream, Koolaupoko district, Oahu; rises in central Koolau Mountains; flows southeastward into Kaneohe Bay; water used for rice irrigation.

Waikane, village and post office, Koolaupoko district, Oahu.

Waikapu, land division in Government ownership, Hamakua district, Hawaii.

Waikapu, large land division, Wailuku district, Maui.

Waikapu, stream, Wailuku district, Maui; rises on eastern slope of West Maui, and flows eastward and southward, only flood water reaching the sea; water diverted through several ditches for cane irrigation.

Waikapu, village and plantation camp, a few miles south of Wailuku, Maui.

Waikapu, South Side ditch, diversion from south side of Waikapu Stream, West Maui, for cane irrigation.

Waikaumalo, land division, North Hilo district, Hawaii.

Waikaumalo, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea north of Honohina.

Waikele, land division, Ewa district, Oahu.

Waikiki, famous beach and bathing section of Honolulu City, Oahu.

Waikoekoe, land division, Hamakua district, Hawaii.

Waikoko, land division, Hanalei district, Kauai.

Waikola, small stream on lower eastern slope of Mauna Kea, Hawaii; entering the sea north of Waikaumalo Stream.

Waikoloa, large land division, South Kohala district, Hawaii.

Waikolu, land division in Government ownership, northern Molokai.

Waikolu, short stream, northern Molokai; flows northwestward into sea through Waikolu Gulch and Valley; water used for taro irrigation.

Wailau, large land division in Government ownership, northwestern Molokai.

Wailau, large stream, northeastern Molokai; rises at 4,900 feet elevation; flows northeastward and northward into sea through Wailau Gulch, which is very deep; water used for taro irrigation; accessible only from the sea.

Wailau, peak at head of Wailau Gulch, Molokai; elevation, 4,547 feet.

Wailua, large land division in Government ownership, Lihue district, Kauai.

Wailua, large stream, Lihue district, Kauai; formed by junction of North and South Forks of Wailua River; flows eastward into sea; receives flow of Opaikaa Stream from the north; water used for rice irrigation.

Wailua, main tributary of Umauma Stream on eastern slope of Mauna Kea, Hawaii.

Wailua, North Fork, large stream, Lihue district, Kauai; rises on eastern slope of Waialeale; flows eastward to junction with South Fork to form main stream, receives several tributaries from the north; water used for cane irrigation.

Wailua, South Fork, large stream, Lihue district, Kauai; rises on southeastern slope of Kawaikini; flows eastward to junction with North Fork to form main stream; receives numerous tributaries from north and south; water used for cane irrigation.

Wailuaiki, stream, Hana district, Maui; rises on the northeastern slope of Haleakala; flows northeastward into sea near Wailua; supplies water to Koolau ditch.

Wailuanui, stream, Hana district, Maui; rises on northeastern slope of Haleakala; flows northeastward into sea, east of Keanae Valley; supplies water to Koolau ditch.

Wailuku, district, Maui County; political subdivision in windward West Maui; population (1910), 11,742.

Wailuku, large land division, Wailuku district, Maui.

Wailuku, river, South Hilo district, Hawaii; rises high up on southeastern slope of Mauna Kea; flows eastward into Hilo Bay, receiving in its course numerous tributaries from the north; southernmost stream in Hawaii.

Wailuku, town and post office, about 3 miles west of Kahului Harbor, East Maui; county seat of Maui County; site of Wailuku Sugar Co.'s mill.

Wailupe, land division, Honolulu district, Oahu.

Waima, tributary of Waipio River, Hamakua district, Hawaii; rises on northern slope of Kohala Mountains, entering Waipio River from the west.

Waimalu, land division, Ewa district, Oahu.

Waimalu, small stream, Ewa district, Oahu; rises in Koolau Mountains; flows southwestward through Waimalu Gulch into East Loch of Pearl Harbor; water used for cane irrigation during freshets.

Waimanalo, ditch diverting water from various tributaries of Kailua Stream, Oahu, for irrigation of cane at Waimanalo.

Waimanalo, land division, Ewa district, Oahu.

Waimanalo, land division, in Government ownership, Koolaupoko district, Oahu.

Waimanalo, shallow bay on southeast coast of Oahu.

Waimanalo, stream, Koolaupoko district, Oahu; rises in southern Koolau Mountains; flows northeastward into Waimanalo Bay; water used for cane irrigation.

Waimanalo, village and post office, Koolaupoko district, Oahu; site of Waimanalo Sugar Co.'s mill.

Waimano, land division in Government ownership, Ewa district, Oahu.

Waimanu, land division in Government ownership, Hamakua district, Hawaii.

Waimanu, stream, Hamakua district, Hawaii; heads in Waimanu Gulch north of Waipio River; flows northward into sea, through Waimanu Valley.

Waimea, bay at mouth of Waimea River, southwest Kauai.

Waimea, district, Kauai County; political subdivision in southwestern Kauai; population (1910), 7,987.

Waimea, ditch diverting water from Waimea River, Kauai, about 4 miles above its mouth.

Waimea, ditch, Waimea district, Kauai; diverts water from the west side of Waimea River for cane irrigation.

Waimea, land division in Government ownership, Waimea district, Kauai; large, comprising about one-fifth of total area of island.

Waimea, land division in Wailua district, Oahu.

Waimea, picturesque canyon, Kauai; 2,000 to 3,000 feet deep; ½ to 1½ miles wide, about 10 miles long; called "Miniature Grand Canyon."

Waimea, river in Waimea land division, Kauai; rises in Alakai Swamp northwest of Waialeale Peak; flows southward through deep, picturesque canyon to Waimea Bay; length, about 15 miles, the longest on Kauai; receives principal tributaries from the east; water diverted for irrigation through Kekaha, Waimea, and smaller ditches.

Waimea, small bay at mouth of Waimea Stream, northwest Oahu.

Waimea, stream, Waialua district, Oahu; rises in northern Koolau Mountains; flows northwestward into Waimea Bay.

Waimea, town and post office at mouth of Waimea River, Waimea district, Kauai.

Waimea, very large land division, South Kohala district, Hawaii.

Waimea, village (post office, Kamuela), on Waimea Plains, southeast of Kohala Mountains, Hawaii.

Waimea, westernmost landing for freight and passengers on southern coast of Kauai.

Wainaku, suburb of Hilo and freight landing, South Hilo district, Hawaii.

Wainiha, canal, Hanalei district, Kauai; diverts water from the west side of Wainiha River for power.

Wainiha, large land division, Hanalei district, Kauai.

Wainiha, large stream, Hanalei district, Kauai; rises on northern slope of Waialeale: flows northward to Wainiha Bay; receives numerous short tributaries from east and west; water used for power and for irrigation of rice and taro in Wainiha Valley.

Wainiha, post office and landing, Hanalei district, Kauai.

Waioa, short stream, Hanalei district, Kauai; flows northward into Hanalei Bay.

Waiohinu, large land division in Government ownership, Kau district, Hawaii.

Waiohinu, village and post office, Kau district, Hawaii.

Waiohue, small stream, Hana district, Maui; rises on northeastern slope of Haleakala; flows northeastward into sea; supplies water to Koolau ditch.

Waiohuli, large land division in Government ownership; Wailuku and Makawao districts, Maui.

Waioli, land division, partly in Government ownership, Hanalei district, Kauai.

Waioli, short stream, Hanalei district, Kauai; flows northward into Hanalei Bay.

Waiomao, short stream, Honolulu district, Oahu; rises on southern slope of Olympus, Koolau Range; flows southward to junction with Pukele Stream to form Palolo Stream.

Waipa, land division, Hanalei district, Kauai.

Waipahoehoe, stream, Hilo district, Hawaii; rises on eastern slope of Mauna Kea; flows southeastward into sea south of Papaikou.

Waipahu, stream, Ewa district, Oahu; formed by junction of Kipapa and Waikahalaua streams; flows southward into West Loch of Pearl Harbor; water used for rice irrigation.

Waipahu, town and post office on West Loch of Pearl Harbor, Oahu; site of Oahu Sugar Co.'s mill.

Waipake, small land division, Hanalei district, Kauai.

Waipau, long gulch, Waimea district, Kauai.

Waipio, land division, Hamakua district, Hawaii.

Waipio, large land division, Ewa district, Oahu.

Waipio, river, Hamakua district, Hawaii; rises on northeastern slope of **Kohala** Mountains; flows eastward and northeastward into sea through Waipio Valley; receives the flow of Kawainui, Alakahi, Koiawe, and Waima streams; source of Hamakua ditches.

Waipio, village at mouth of Waipio Valley, Hamakua district, Hawaii.

Waipouli, land division, Kawaihau district, Kauai.

Waipunalei, very small stream on eastern slope of Mauna Kea, Hawaii; entering sea north of Laupahoehoe.

Walbridge, ditch diverting water from south side of Iao Stream, West Maui, for cane irrigation.

Watertown, village and post office at entrance to Pearl Harbor, Oahu.

Weliweli, land division, Koloa district, Kauai.

Weloka, small stream on lower eastern slope of Mauna Kea, Hawaii; entering sea just north of Maulua Gulch.

Wilcox ditch, Koloa district, Kauai; diverts water from the south side of Huleia Stream for cane irrigation.

Woods ditch, Kohala district, Hawaii; under construction for cane irrigation.

INDEX.

A.

Page.

Aakukui, rainfall at, records of 423
Accuracy of data 31–32
Acknowledgements to those aiding 13–14
Acre-foot, definition of 24
Agricultural products, dependence of, on irrigation 15
value of exports 15
Ahole Stream, miscellaneous discharge measurements on 391
Ahuimanu, rainfall at, records of 442
Aiea, ditches near, miscellaneous discharge measurements on 186
Honolulu plantation well at, section of 192
water pumped from, monthly summary of 193
rainfall at, records of 436–437
Ainone ditch, discharge measurement 185
Upper Kailua ditch below, discharge measurements 185
Akulikuli Springs near Kapaa, records of flow of 114–115
Alakahi, rainfall at, records of 478
Alakahi Stream near Waipio, records of flow of 400–401
Alalakeiki Channel, width of 197
Aleamai Stream, miscellaneous discharge measurements on 390
Alenuihaha Channel, width of 197, 332
Alexander & Baldwin (Ltd.), assistance by 13
Alexander, F. A., assistance by 14
Alexander, Sam, Baldwin, H. P., and, old Hamakua ditch built by 98
Allotment, Board of, appointment of 12
Allotment, Federal 13
Territorial 13
Alo division weir, Koolau ditch at, records of flow of 262–268
Alo Stream near Huelo, records of flow of 274–276
Amalu Stream, Honokawai Stream below junction with 256
near Lahaina, above junction with Honokawai Stream, discharge measurement 257
Anahola ditch near Kealia, records of flow of, at Kiokala 132–135
at Makai weir 135–137
Anahola-Kealia-Kalihiwai divide, rainfall on, records of 426
Anahola River above confluence with Keaoopu Stream, discharge measurement 143
diversions from 128
Keaoopu Stream above confluence with, discharge measurement 143
near Kealia, records of flow of, above dam at Kiokala 129–130

Page.

Anahola River basin, position and area of 128
rainfall in 128
Anahula-Opaeula divide, rainfall on, records of 441
Appropriations for water-resources investigations 11
Auau Channel, width of 197
Austin, C. J., assistance by 14
Authority for investigations 11–12
Awini, rainfall at, records of 479
Awini Stream basin, rainfall in, records of 479

B.

Baldwin, B. D., assistance by 14
Baldwin, F. F., assistance by 14
Baldwin, H. A., assistance by 14
Baldwin, H. P., and Alexander, Sam, Old Hamakua ditch built by 298
Ball, W. E., assistance by 14
Banana plantation near Honolulu, view of, plate showing 16
Bishop (B. P.) Estate, assistance by 14
Bluett, P. W. P., assistance by 14
Boyd ditch, discharge measurements 159, 160
Brecht, E., assistance by 14
Brecht, O., assistance by 14
Brewer (C.) & Co. (Ltd.), assistance by 13
Bridge gaging station, view of, plate showing. 22
measurements at 22
Broadbent, E. H. W., assistance by 14
Bull, E. K., assistance by 14
Bureau of Forestry, assistance by 13

C.

Cable station, view of, plate showing 22
measurements at 22
Campbell, Marston, appointed member of board of allotment 12
assistance by 13
Castle & Cook (Ltd.), assistance by 13
Castle, J. B., assistance by 14
Center ditch near Huelo, records of flow of 294–297
Center ditch region, area tributary to 294
rainfall in, records of 456
China ditch near Hanalei, records of flow of 138
Coast and Geodetic Survey magnetic station, rainfall at, records of 439
Cockett, Pia, assistance by 14
Coefficients for reducing velocity determinations to the mean 21
Collins, A. W., assistance by 14
Computations, accuracy of 31–32
methods of making 26–29
Cooke, J. P., appointed chairman of board of allotment 12
assistance by 13

Page.

Cooperative agreement, features of 12
Coral along coasts of Maui Island, occurrence of. 198
Coral reefs of Oahu 147
Culvert Creek near Wailuku, discharge measurement 256
Current meters, features of 19–20
use of, in measuring velocity of streams .. 19–22
view of, plate showing 18

D.

Davies & Co. (Ltd.), assistance by 13
Ditch country, East Maui, investigations in .. 259
rainfall in 259
records of flow in 260–330
Dodge, F. B., work of 13
Dodge, F. S., assistance by 14

E.

East Branch. *See name of main stream.*
Eckart, C. F., assistance by 13
Ehui (Peleau) Stream, miscellaneous discharge measurements on 391
Eleele, Hanapepe ditch near, records of flow. 81–85
Hanapepe River near, records of flow 77–80
Hiloa ditch near, records of flow at Hanapepe Falls 87–88
Hiloa Stream near, records of flow 86
rainfall at, records of 419
Eneamo ditch near Kekaha ditch siphon, discharge measurement 144
Equivalents for use in hydraulic computations 25
Erehwon (Kula), rainfall at, records of 460
Evaporation, methods of measuring 487
on Hawaii Island, records of 491
on Kauai Island, records of 487–489
on Oahu Island, records of 490
Everett ditch. *See* Palolo ditch.
Ewa, ditches near, discharge measurements .. 186
Ewa plantation, rainfall at, records of 439
Ewa Plantation Co., assistance by 14
water pumped by, at Ewa Mill, monthly summary of 194–195
Expenditures for investigations 13

F.

Fairchild, G. H., assistance by 14
Fassoth, John, assistance by 14
Faye, H. P., assistance by 14
Fleming, D. T., assistance by 14
Floats, subsurface, use of, in measuring velocity of streams 19
Forestry, Bureau of, assistance by 13
Fraser, Dexter, work of 13
Frear, Walter F., board of allotment appointed by 12

G.

Gages, datum of 22
placing of 22
Gages, automatic, essential features of 23
Gaging stations, classes of 17, 26–29
list of 32–35
sites for, selection of 22
types of, view of, plates showing 16, 19
Gallons per minute, definition of 24
Gartley, Alonzo, assistance by 13
Gay & Robinson, assistance by 14

Page.

Gay, Francis, assistance by 14
Gazetteer 509–536
Geographic names, glossary of 498–506
Gibb, George, assistance by 14
Gibb, James, assistance by 14
Gilmore, J. W., assistance by 14
Glossary of geographic names 498–506
Goo, E. E., work of 13
Goodale, W. W., assistance by 14
Green Lake, features of 335
Grove Farm, rainfall at, records of 424
Grove Farm Plantation, assistance by 14

H.

Hackfield (H.) & Co. (Ltd.), assistance by .. 13
Hackfield, J. F., assistance by 13
Haiku, rainfall at, records of 459
Haiku ditch near Hamakuapoko, discharge measurements 330
near Huelo, records of flow of, at Peahi weir 328–330
Haipuaena Stream near Huelo, records of flow of 268–271
Hakalau, rainfall at, records of 469
Hakalau mauka, rainfall at, records of 469
Hakalau Stream, miscellaneous discharge measurements on 391
Hakalau Stream basin, rainfall in, records of. 469
Halaula, rainfall at, records of 427
Halawa Stream basin, rainfall in, records of. 436–437
Haleakala crater, altitude of 198
features of 198
Haleakala ranch, rainfall at, records of 457
Halehaku Stream near Huelo, records of flow of 312–315
Halehaku weir, New Hamakua ditch at, records of flow of 320–322
Halekua Stream, below Koholoina Stream, discharge measurement 143
Koholoina Stream above confluence with, discharge measurement 143
Halemanu Stream, Kauai Island, discharge measurement 143
Halona Stream, miscellaneous discharge measurements of 183, 186
near Waikane, records of flow of 182
Hamakua ditch (Hawaii Island), New, near Kukuikaele, records of flow of . 395–397
near Waipio, records of flow of 395
water of 392
weir on, view of, plate showing 346
Old or upper, water of 392
Hamakua ditch (Maui Island), New, Halehaku Stream at, records of flow of 314–315
length and capacity of 298
near Huelo, records of flow of, at Halehaku weir 320–322
records of flow of, at Nailiilihaele weir 318–320
Old, length and capacity of 298
Nailiilihaeleliilii Stream below intake of 330
Nailiilihaele Stream below intake of, discharge measurements 330
near Huelo, records of flow of, at Opana weir 322–324

Page.

Hamakua ditch region, Maui Island, features of ... 298
streams and ditches of, records of flow of 298–330
Hamakua group of streams, Hawaii Island, miscellaneous discharge measurements of ... 402
position of ... 392
records of flow of ... 392–402
Hamakuapoko, Haiku ditch near, discharge measurements ... 330
Kaluanui ditch near, records of flow of. 324–326
Lowrie ditch near, discharge measurements ... 330
Hana, rainfall at and near, records of ... 454
Hanahanapuni, rainfall at, records of ... 425
Hanalei, China ditch near, records of flow of. 138
rainfall at, records of ... 428
Waioli Stream near, discharge measurement ... 143
Hanalei River, diversions from ... 138
divide between North Fork of Wailua River and, rainfall on, records of. 425
near Hanalei, records of flow of ... 138
Hanalei River basin, area and position of ... 137
rainfall in ... 138
Hanalei-Kalihiwai divide, rainfall on, records of ... 428
Hanamaula, rainfall at, records of ... 424
Hanam ulu ditch near Lihue, records of flow ... 98–101
Hanamaulu River near Lihue, records of flow 88–89
Hanamaulu River basin, features of ... 88
rainfall in ... 88
Hanapepe, rainfall at Camp No. 2 near, records of ... 418
Hanapepe ditch, miscellaneous discharge measurements of ... 144
near Eleele, records of flow at Hanapepe Falls ... 81–82
records of flow at Koula ... 82–85
near Makaweli, records of flow ... 85
Hanapepe Falls, Hanapepe ditch near, records of flow ... 81–82
Hanapepe River at, records of flow ... 77
Hiloa ditch at, records of flow ... 87–88
Hiloa Stream at, records of flow ... 86
rainfall below, record of ... 41
Hanapepe-Hiloa divide, rainfall on, record of. 417
Hanapepe River basin, features of ... 76
rainfall in ... 76
records of ... 417–418
Hanapepe River, branches of ... 76
cable station on, view of, plate showing. 19
diversions from ... 76
falls on ... 76
Manuahi Stream above confluence with, discharge measurement ... 143
near Eleele, records of flow at Hanapepe Falls ... 77
records of flow at Koula ... 78–80
Hanapepe Valley, rainfall in, records of ... 41
Hanawai Stream, miscellaneous discharge measurements ... 390
Hapea, lower, rainfall at, records of ... 473
Hapea, mauka, rainfall at, records of ... 472–473
Hardy, W. V., work of ... 13
Harvey, F. E., assistance by ... 14

Page.

Haunapueo Stream, miscellaneous discharge measurements ... 391
Hauula, Kaipapau Stream near, records of flow of ... 174
Kaluanui Stream near, records of flow of ... 174–175
Hawaii, College of, assistance by ... 14
Manoa Stream at, records of flow of ... 155–157
Hawaii Island, area of ... 332
evaporation on, records of ... 491
gaging stations on, list of records obtained at ... 35
map showing ... End of volume.
lava flows of ... 335
view of, plate showing ... 198
map of, showing location of gaging stations ... End of volume.
origin of ... 333, 335
position of ... 332
rainfall on ... 333, 334
records of ... 462–486
shape of ... 332
springs and underground waters of ... 335, 408
streams of ... 333, 334, 335
streams of, list of ... 508–509
temperature on, records of ... 494–955
volcanoes of ... 333
Hawaiian Commercial & Sugar Co., assistance by ... 14
camp No. 7, rainfall at, records of ... 459
water pumped by, at Puunene, monthly summary of ... 332
Hawaiian Irrigation Co. (Ltd.), assistance by. 14
Hawaiian Sugar Planters' Association, assistance by ... 13
Hawaiian Sugar Co. (Ltd.), assistance by ... 14
Hawaiian words, list of those in common use ... 496–497
pronunciation of ... 496–498
Hawi mill, rainfall at, records of ... 481
Heeia, rainfall at, records of ... 442
Henderson, James, assistance by ... 14
Hilea, rainfall at, records of ... 483
Hilo, breakwater at, records of rainfall at ... 465
forest back of, rain gages in ... 346
view of, plate showing ... 334
Honolii River near ... 341–344
Maili Stream near, discharge measurements ... 390
rainfall at, records of ... 465
rainfall in forest back of ... 349
streams between Laupahoehoe and, miscellaneous discharge measurements ... 390–391
streams in forest back of, at 2,500-foot level, combined flow of ... 347–348
at 2,500-foot level, features of ... 346
records of flow of, at stations ... 349–389
at 1,800 to 2,000 foot level, miscellaneous measurements ... 389–390
temperature at, records of ... 494
Uhakauwai Stream near, discharge measurements ... 390
Wailuku River near, discharge, area, and mean velocity curves for ... 339
minimum discharge of ... 347
records of flow of ... 337–340

Page.

Hilo group of streams, area drained by, rainfall on ... 336
features of ... 336
low-water periods in ... 347
miscellaneous discharge measurements in ... 391–392
records of flow of ... 336–389
Hilo Sugar Co., assistance by ... 14
Hilo water reservation, discharge measurement ... 392
Hiloa ditch near Eleele, records of flow at Hanapepe Falls ... 87–88
Hiloa-Hanapepe divide, rainfall on, record of ... 417
Hiloa Stream near Eleele, records of flow at Hanapepe Falls ... 86
Hoaeae, evaporation at, records of ... 490
rainfall at, records of ... 438
Hokumahoe Stream, miscellaneous discharge measurements ... 391
Homestead, rainfall at, records of ... 420
Honohina, rainfall at, records of ... 469
Honolii ditch near, records of flow of ... 344
Honolii River near, diagram showing fluctuation in stage of ... 342
records of flow of ... 341–344
Honokaa, rainfall at and near, records of ... 477
Honokahau, Honokahau ditch near, miscellaneous discharge measurements ... 257
Honokahau ditch near, records of flow of ... 248–254
Honokahau Stream near, records of flow of ... 247–248
Honolua ditch near, records of flow of ... 247
Honolua Stream near, records of flow of ... 246–247
Honokahau Stream, diversions from ... 247
near Honokahau, records of flow of ... 247–248
Honokahau Stream basin, position of ... 247
rainfall in ... 247
records of ... 452–453
Honokahau ditch near Honokahau, miscellaneous discharge measurements ... 257
near Honokahau, records of flow of, above Honolua Stream ... 252–254
records of flow of, at intake ... 248–252
near Lahaina, records of flow of ... 254–256
Honokahua ditch intake, rainfall at, records of ... 453
Honokahua Gulch, rainfall at, records of ... 453
Honokane, East and West branches of Honokane Stream near, records of flow of ... 404–405
rainfall at, records of ... 479
Honokane Stream, branches of, diversions from ... 403
branches of, miscellaneous discharge measurements ... 407
near Honokane, records of flow of ... 404–405
Honokane Stream basin, miscellaneous discharge measurements ...
rainfall in ... 403
records of ... 479
Honokawai ditch below power house, discharge measurement ... 257
Honokawai Gulch, rainfall at, records of ... 451
Honokawai power house, Honokawai ditch below, discharge measurement ... 257
rainfall at, records of ... 451

Page.

Honokawai Stream near Kaanapali, discharge measurement ... 256
near Lahaina, records of flow of ... 244–246
tributary of ... 244
Honokawai Stream basin, position of ... 244
rainfall in, records of ... 450–451
Honokawai tunnels near Kaanapali, discharge measurements ... 258
Honolii ditch at Kaiwiki, near Hilo, records of flow of ... 344
Honolii River at Kaiwiki, near Hilo, records of flow of ... 341–344
diversions from ... 341
minimum discharge of ... 347
near Hilo, diagram showing fluctuation in stage of ... 343
view of, plate showing ... 334
tributaries of ... 340–341
combined flow of ... 347
Honolii River basin, features of ... 340–341
Honolii Stream, miscellaneous discharge measurements ... 390
Honolua, rainfall at, records of ... 453
Honolua ditch near Honokahau, records of flow of ... 247
Honolua ranch, assistance by ... 14
Honolua Stream near Honokahau, records of flow of ... 246–247
Honolua Stream basin, position of ... 246
Honolulu, banana plantation near, view of, plate showing ... 15
evaporation at, records of ... 490, 491
flowing wells in and near, miscellaneous discharge measurements ... 188–189
Kahuawai spring near, discharge measurements ... 188
Luakaha ditch near, records of flow of ... 166–168
Lulumaho ditch near, records of flow of ... 164–166
Manoa Stream near, records of flow of ... 152–159
Nuuanu Stream at, records of flow of ... 163–164
Pauoa Stream near, records of flow of ... 160–162
rainfall at, records of ... 432–434, 435, 436
springs in and near, discharge measurements ... 188
temperature at, records of ... 493
Waiomao Stream near, records of flow of ... 149–151
Honolulu Plantation Co., assistance by ... 14
water pumped by, at Aiea, monthly summary of ... 193
well of, section of ... 192
Honomanu, rainfall at, records of ... 455
temperature at, records of ... 494
Honomu Stream, miscellaneous discharge measurements ... 391
Honopou Stream near Huelo, records of flow of ... 310–312
Hoolawaliilii Stream near Huelo, records of flow of ... 306–308
Hoolawanui Stream near Huelo, records of flow of ... 308–310
Horner, Albert, assistance by ... 14
Horner, Robert, assistance by ... 14
Hosmer, R. S., assistance by ... 13
Howell, Hugh, assistance by ... 14
Hualalai Mountain, features of ... 334
Hubbard, S. E., assistance by ... 14

Page.

Huehue, rainfall at, records of 481
Huekipo, Kekaha ditch below, discharge measurements 144
Huekipo weir, Kekaha ditch above, discharge measurement 144
Huelo, Alo Stream near, records of flow of.. 274–276
Center ditch near, records of flow of.... 294–297
Haiku ditch near, records of flow of.... 328–330
Haipuaena Stream near, records of flow of 268–271
Halehaku Stream near, records of flow of 312–315
Honopou Stream near, records of flow of 310–312
Hoolawaliilii Stream near Huelo, records of flow of 306–308
Hoolawanui Stream near, records of flow of 308–310
Kailua Stream near, records of flow of . 301–303
Koolau ditch near, records of flow of... 262–268
Lowrie ditch near, records of flow of... 326–328
Naiiilihaele Stream near, discharge measurements 330
records of flow of 298–301
Naiiilihaelelilii Stream near, discharge measurements 330
New Hamakua ditch near, records of flow of 318–322
Oanui Stream near, records of flow of.. 303–306
Old Hamakua ditch near, records of flow of 322–324
Oopuola Stream near, records of flow of 278–281
Opana ditch near, records of flow of.... 317–318
Opana Stream near, records of flow of.... 316
Puohakamoa Stream near, records of flow of 271–273
Spreckels ditch near, miscellaneous discharge measurements 330
records of flow of 281–294
Waikamoi Stream near, records of flow of 276–278
Hulei River basin, rainfall in, records of... 422–423
Huliilii Stream, discharge measurement 391
Huluhulunui bridge, Kekaha ditch near, discharge measurements 144
Humuula, rainfall at, records of 463
temperature at, records of 495
Hundley, S. N., assistance by 14

I.

Iao Stream, diversions from 218
near Wailuku, discharge measurements above and below gaging station.. 256
rainfall at, records of 446
records of flow of 218–221
source of water of 218
Iao Stream basin, area of 218
position of 218
rainfall in, records of 445–446
topography of 218
Iao tunnels near Wailuku, discharge measurements 258
Iao Valley, views in, plate showing 198
Iao Valley cave, rainfall at, records of 445
Iao Valley tableland, rainfall on, records of.. 446
Integration method of measuring stream flow. 21

Page.

Investigations, authority for 11–12
Irrigation systems, need for study of 15
Isenberg (Tantalus), rainfall at, records of... 431

J.

Jorgensen, Jorgen, assistance by 14
Judd, C. S., assistance by 13

K.

Kaahakini Stream, miscellaneous discharge measurements 391
Kaaikahi Spring, discharge measurement.... 163
Kaala Gulch, rainfall at, records of 440
Kaala Peak, altitude of 146
Kaanapali, Honokawai Stream near, discharge measurement 256
Honokawai tunnels near, discharge measurements 258
rainfall at, records of 452
temperature at, records of 494
Kaau Stream, discharge measurement 152
Kaehulua Stream, weirs on branches of, records of flow over 108–109
Kaehulua Stream basin, position of 106–107
Kahana-Makuone divide, rainfall on, record of 415
Kahana Stream, discharge measurement 177
Kahana Stream basin, miscellaneous discharge measurements in 177
position of 177
Kahina Pukii Stream, miscellaneous discharge measurements 391
Kahoalele Falls, view of, plate showing 38
Kahoma ditch near Lahaina, records of flow of 243–244
Kahoma ditch, Old, near Lahaina, discharge measurements 257
Kahoma Stream near Lahaina, records of flow of 242–243
Kahoma Stream basin, position of 241
Kahoolawe Island, rainfall on, records of... 460–461
Kahuawai Spring near Honolulu, discharge measurements 188
Pauoa Stream below, records of flow of. 160–162
Pauoa Stream near, discharge measurement 163
Kahuku, rainfall at, records of 441
Kahului, rainfall at, records of 448
Kaieie Stream, diversion ditch from, discharge measurement 390
miscellaneous discharge measurements... 390
Kaieie Waho channel, width of 36
Kaikekee ditch, discharge measurements 186
Kailua ditch, Upper, above Waimanalo reservoir, discharge measurement... 185
below Ainone ditch, discharge measurement 185
Kailua, rainfall at, records of 456
Kailua-Manoa divide, rainfall on, records of.. 431
Kailua Stream near Huelo, records of flow of 301–303
Kailua Stream, Middle Fork, discharge measurement 185
Kailua Stream, North Fork, discharge measurement 185
Kailua Stream, South Fork, discharge measurement 185

Page.

Kailua Stream basin, diversions from, to Waimanalo basin. 185
miscellaneous discharge measurements in 185
position of..... 185
rainfall in, records of 442
Kainahola weir, position of..... 107
records of flow over, near Kapaa..... 108
Kaipapau Stream near Hauula, records of flow of..... 173–174
Kaipapau Stream basin, position of..... 173–174
Kaiwi channel, width of..... 145
Kaiwiki, Honolii ditch at, records of flow of. 344
Hololii River at, diagram showing fluctuation in stage of..... 343
records of flow of..... 341, 344
view of, plate showing..... 334
Kalana Auwai ditch (north side) above Wailuku, discharge measurement.... 257
Kalaoa Stream, miscellaneous discharge measurements..... 390
Kalehuahakihaki Stream, discharge measurement..... 143
Kaleiiki and Kapena streams, discharge measurements, below confluence..... 391
Kalihi, section of well at..... 192
Kalihi Stream, above all diversions, discharge measurements..... 169
use of, for irrigation..... 169
Kalihi Stream basin, miscellaneous discharge measurements in..... 169
position of..... 168
Kalihiwai above Kalihiwai village, discharge measurement..... 143
Kalihiwai-Anahola-Kealia divide, rainfall on, records of..... 426
Kalihiwai-Hanalei divide, rainfall on, records of..... 428
Kaliula, rainfall at, records of..... 432
Kalopa, rainfall at, records of..... 476
Kaluanui ditch below intake, discharge measurement..... 175
near Hamakuapoko, records of flow of, at Puuomalei..... 324–326
Kaluanui Stream, diversions from..... 174
miscellaneous discharge measurements... 175
near Hauula, records of flow of..... 174–175
Kaluanui Stream basin, position of..... 174
Kama Auwai (south side) ditch above Wailuku, discharge measurements... 257
Kamenehune ditch near Waimea, records of flow..... 68–69
Kamoola ditch, rainfall at, records of..... 422
Kanaha ditch near Lihue, records of flow.. 105–106
Kaneha, Kaneha ditch at, records of flow of. 125–127
Kaneha ditch, below intake, discharge measurement..... 144
near Kealia, records of flow of..... 125–127
Kaneohe, rainfall at, records of..... 442
Kaneohoe Stream, North Branch, discharge measurements..... 184
Kaneohoe Stream, South Branch, discharge measurements..... 184
Kaneohe Stream basin, miscellaneous discharge measurements of..... 184
position of..... 184
rainfall in, records of..... 442
Kaoheiki Stream, miscellaneous discharge measurements..... 391

Page.

Kapaa, Akulikuli Springs near, records of flow of..... 114–115
Kainahola weir near, records of flow over. 108
Kapaa ditch near, records of flow of.... 121–123
Kapaa River near, records of flow..... 111–114
Kapahi ditch near, records of flow of... 115–117
Kuhinoa weir near, records of flow over.. 110
Makakualele weir near, records of flow over..... 107–108
Pipe ditch near, records of flow of..... 123–125
Rice ditch near, discharge measurement. 144
Tunnel ditch near, records of flow of... 118–120
Wainamuamu weir near, records of flow over..... 109
Kapaa ditch near Kapaa, records of flow of, at Kapahi..... 121–123
Kapaa River, below confluence of Kealia and Kapaa streams, discharge measurement..... 143
branches of..... 111
divide between North Fork of Wailua River and, rainfall on, records of.. 426
near Kapaa, records of flow..... 111–114
Kapaa River basin, features of..... 111
rainfall in.. 111
records of..... 426, 427
Kapaa Stream, above confluence with Kealia Stream, discharge measurement.. 143
diversions from..... 111
Kapaa River below confluence of with Kealia Stream, discharge measurement..... 143
Kealia Stream above confluence with, discharge measurement..... 143
Kapahehe Stream, miscellaneous discharge measurements..... 391
Kapahi, Kapaa ditch at, records of flow of.. 121–123
Kapaa River at, records of flow..... 111–114
Kapahi ditch at, records of flow of..... 115–117
Pipe ditch at, records of flow of..... 123–125
rainfall at, records of..... 427
Tunnel ditch at, records of flow of..... 118–120
Kapahi ditch, discharge measurement..... 144
near Kapaa, records of flow of, at Kapahi..... 115–117
Kapaia, Hanamaulu River at, records of flow. 88–89
Kapaia Stream basin, rainfall in, records of... 424
Kapaka, rainfall at, records of..... 428
Kapapala ranch, rainfall at, records of..... 484
Kapeha Stream, Hawaii, miscellaneous discharge measurements..... 390
Kapehu Stream, Hawaii, miscellaneous discharge measurements..... 391
Kapehuaala Peak, altitude of..... 111
Kapena and Kaleiiki streams, discharge measurements, below confluence..... 391
Kapoho, rainfall at, records of..... 485
Kapue Stream, miscellaneous discharge measurements..... 390
Kapuna ditch, north side, above Waihee, discharge measurements..... 257
Kau, rainfall at, records of..... 483
Kauai Electric Co. (Ltd.), assistance by..... 14
Kauai Electric Co. power house, rainfall at, record of..... 429
Kauai Island, agricultural products of..... 38
comparison of, with the other islands.... 37–38

Page.

Kauai Island, dimensions of..... 36
erosion on..... 38
evaporation on, records of..... 487–489
gaging stations on, list of..... 32–33
records obtained at..... 39–142
map of, showing location of gaging stations..... End of volume.
miscellaneous stream measurements on.. 143
population of..... 38
pumped water on..... 144
rainfall on..... 38
rainfall stations on, lists of..... 410, 429
records at..... 410–429
streams of, list of..... 506
temperature on, records of..... 492–493
topography of..... 36–37
vegetation of..... 38
Kauaikanana Stream, discharge measurement..... 143
Kauaula ditch near Lahaina, discharge measurement..... 257
Kauaula Stream near Lahaina, discharge measurement, above Piilani ditch..... 256
records of flow of..... 238
Kauaula Stream basin, area and position of..... 237–238
Kauaula weirs near Lahaina, records of flow over..... 238–239
Kaueleau, rainfall at, records of..... 485
Kaukonahua Stream, branches of..... 169
North Fork of, near Wahiawa, records of flow of..... 170
South Fork, near Wahiawa, records of flow of..... 169–170
Kaukonahua Stream basin, position of..... 169
rainfall in..... 169
records of..... 440
Kawaiiki, rainfall at, records of..... 441
Kawaikini Peak, altitude of..... 36
Kawaikoi Stream near Waimea, records of flow..... 43–48
Kawainui, Kawainui River at, records of flow of..... 345
Kawainui, lower, rainfall at, records of..... 478
Kawainui mauka, rainfall at, records of..... 478
Kawainui River at Kawainui, near Pepeekeo, records of flow of..... 345
branches of..... 344
miscellaneous discharge measurements.. 390
near Pepeekeo, flume and trestle across, view of, plate showing..... 346
Kawainui River basin, features of..... 344
Kawainui of Waipio River, branches of, near Waipio, records of flow of..... 399–400
near Waipio, records of flow of..... 393, 398–399
Kawalii Stream, discharge measurement..... 402
Keaalau Stream, miscellaneous discharge measurements..... 391
Keahua, Lowrie ditch near, discharge measurements..... 330
Kealia, Kaui, Anahola ditch near, records of flow of..... 132–137
Anahola River near, records of flow of.. 129–132
evaporation at, records of..... 489
Kaneha ditch near, records of flow of... 125–127
rainfall at, records of..... 427

Page.

Kealia-Anahola-Kalihiwai divide, Kauai Island, rainfall on, records of..... 426
Kealia, Kahoolawe Island, rainfall at..... 461
Kealia Stream, above confluence with Kapaa Stream, discharge measurement. 143
application of name..... 111
diversions from..... 111
Kapaa Stream above confluence, with, discharge measurement..... 143
Kapaa River below confluence of, with Kapaa Stream, discharge measurement..... 143
Keanae, Koolau ditch near, records of flow of..... 260–262
rainfall at and near, records of..... 455
Keanakolu, rainfall at, records of..... 470
Keanakua, rainfall at, record of..... 415
Keaoopu Stream, above confluence with Anahola River, discharge measurement..... 143
Anahola River above confluence with, discharge measurement..... 143
mention of..... 128
Kehaka, rainfall at, record of..... 417
Kekaha ditch, miscellaneous measurements of..... 144
near Waimea, records of flow, above siphon..... 63–64
records of flow, at flume No. 3..... 62–63
at intake..... 59–62
at weir below tunnel No. 12..... 64–67
Kekaha Sugar Co. (Ltd.), assistance by..... 14
Keneohoe Stream, ditches from, discharge measurements of..... 184
miscellaneous discharge measurements of 184
Kihalani Stream, miscellaneous discharge measurements..... 391
Kihei, rainfall at, records of..... 460
Kikola Stream, miscellaneous discharge measurements..... 390
Kilau Stream, miscellaneous discharge measurements..... 391
Kilauea crater, Hawaii Island, features of.. 334–334
Kilauea, Kauai, rainfall at, records of..... 425
temperature at, records of..... 493
Kilauea Sugar Plantation Co., assistance by. 14
Kilohana, rainfall at, record of..... 410
Kilohana crater:
altitude of..... 88
rainfall at, records of..... 423
Kiokala, Anahola ditch at, records of flow of..... 132–135
Anahola River at and above dam at, records of flow of..... 129–132
Knudsen, Augustus, assistance by..... 14
Knudsen, Eric, assistance by..... 14
Koaie-Mohihi divide, rainfall on, record of... 411
Koaie Stream above confluence with Waimea River, discharge measurement... 143
Waimea River above confluence with, discharge measurement..... 143
Kohala, Kohala ditch near, records of flow of..... 405–407
Kohala Ditch Co. (Ltd.), assistance by..... 14
Kohala ditch, Hawaii Island, near Kohala, records of flow of..... 405–407
Kohala group of streams, members of..... 403

Page.

Kohala group of streams, miscellaneous discharge measurements 407
records of flow of 403–407
Kohala (Maulili), rainfall at, records of 480
Kohala mill, rainfall at, records of 480
Kohala mission, rainfall at, records of 480
Kohala Mountains, features of 333
streams on 333
Koheaka Stream, miscellaneous discharge measurements 391
Koholoina Stream above confluence with Halekua Stream, discharge measurement 143
Halekua Stream below, discharge measurement 143
Kohoma reservoir, rainfall at, records of 450
Koiawe, rainfall at, records of 479
Waipio River below, records of flow of 394
Koiawe Stream near Waipio, records of flow of 401
Kokee, rainfall at, record of 413
Kokee Stream, discharge measurement 143
Kolekole Stream, miscellaneous discharge measurements 391
Koloa, evaporation at, records of 489
rainfall at, records of 421
Koloa Sugar Co., assistance by 14
Konahuanui Peak, rainfall on, records of 434
Konohiki Stream near Kapaa, records of flow of, at Makakualele weir 107–108
East Branch of, discharge measurement 143
North Fork of, discharge measurement 143
Konohiki Stream basin, position of 106–107
Koolau, Laie well at, section of 193
Koolau ditch near Huelo, records of flow of, at Alo division weir 262–268
near Keanae, records of flow of 260–262
near Nahiku, discharge measurements 330
streams contributing to 260
Koolau ditch region, position of 260
rainfall in, records of 455
streams and ditches in, records of flow of 260–268
Koolau Mountains, features of 145, 146–147
lava flows of 146
Kopiliula, rainfall at, records of 455
Koula, Hanapepe ditch at, records of flow 82–85
Hanapepe River at, records of flow 78–80
Kuhinoa weir near Kapaa, records of flow over 110
position of 107
Kukaua, rainfall at, records of 423
Kukaiau mill, rainfall at, records of 475
Kukaiau Plantation Co. office, rainfall at, records of 475
Kukuihaele, feeder ditch near, discharge measurement 402
New Hamakua ditch at, view of weir on, plate showing 346
rainfall at, records of 477
Kukuiula, rainfall at, records of 421
Kula (Erehwon), rainfall at, records of 460
Kumunuiakea Stream, miscellaneous discharge measurements 390
Kupau camp, rainfall at, records of 455
Kurtistown, rainfall at, records of 484

L.

Page.

Lahaina, ditches near, miscellaneous discharge measurements 257
Honokahau ditch near, records of flow of 254–256
Honokawai Stream near, records of flow of 244–246
Kahoma Stream near, records of flow of 242–243
Kauaula ditch near, discharge measurement 257
Kauaula Stream near, discharge measurement above Piilani ditch 256
records of flow of 238
Kauaula weirs near, records of flow over 238–239
Kehoma ditch near, records of flow of 243–244
Lahainaluna ditch near, miscellaneous discharge measurements 257
Lahainaluna Stream near, records of flow of 239–240
Lahainaluna weirs Nos. 1 and 2 near, records of flow over 241
Launiupoko ditch near, discharge measurements 257
Launiupoko Stream near, records of flow of 236–237
Launiupoko tunnel near, discharge measurement 258
Old Kahoma ditch near, discharge measurements 257
Piilani ditch near, discharge measurement 257
water pumped at, monthly summary of 258
Lahainaluna ditch near Lahaina, miscellaneous discharge measurements 257
Lahainaluna Stream near Lahaina, records of flow of 239–240
Lahainaluna Stream basin, position of 239
Lahainaluna weirs near Lahaina, records of flow over 241
Laie well, section of 193
Lali Stream, discharge measurements 143
North Fork of, discharge measurement 143
Launiupoko ditch near Lahaina, discharge measurement 257
Launiupoko Stream near Lahaina, records of flow of 236–237
Launiupoko Stream basin, position of 236
Launiupoko tunnel near Lahaina, discharge measurement 258
Laupahoehoe, rainfall at, records of 470
streams between Hilo and, miscellaneous discharge measurements 390–391
Laupahoehoe Stream, miscellaneous discharge measurements 391
Lawai, rainfall at, records of 420–421
Lawai, East, rainfall at, records of 420
Lawai Beach, rainfall at, records of 421
Lawai Stream basin, rainfall in, records of 420
Legislation providing conservation funds, passage of 12
Lehuamakanoi, rainfall at, record of 411
Lihue, Hanamaulu ditch near, records of flow 98–101
Hanamaulu River near, records of flow 88–89
Kanaha ditch near, records of flow 105–106
Lihue ditch near, records of flow 95–98

Page.
Lihue, North Fork of Wailua River near, diagram showing fluctuations in stage of ... 102
records of flow ... 101–105
rainfall at, records of ... 423, 424
South Fork of Wailua River near, records of flow ... 91–95
temperature at, records of ... 492
Lihue ditch near Lihue, records of flow ... 95–98
Low, E. P., assistance by ... 14
Low, J. S., assistance by ... 14
Lowrie ditch near Hamakuapoko, discharge measurements ... 330
near Huelo, records of flow of, at Opana weir ... 326–328
near Keahua, discharge measurements ... 330
Luakaha ditch near Honolulu, records of flow of ... 166–168
Luakaha, lower and upper, rainfall at, records of ... 435
Luakaha, upper, evaporation at, records of ... 490
Luakaha weir. See Luakaha ditch.
Lualualei Valley, flumes in, discharge measurements ... 186
Lulumaho ditch above reservoir No. 4, discharge measurements ... 168
near Honolulu, records of flow of ... 164–166
Lupi, rainfall at, records of ... 457
Lydgate, Rev. J. M., assistance by ... 14

M.

Mahana, rainfall at, records of ... 452
Mahaulepu, rainfall at, records of ... 422
Maiakii Stream above Waiawaawa reservoir, discharge measurement ... 143
Maili Stream, miscellaneous discharge measurements ... 390
near Hilo, discharge measurements ... 390
Makai tributary of Waianae Stream, discharge measurements ... 173
Makai weir, Anahola ditch at, records of flow of ... 135–137
Makakualele weir near Kapaa, records of flow over ... 107–108
position of ... 107
Makalapa ditch, miscellaneous discharge measurements ... 186
Makapuu, rainfall at, records of ... 430
Makawao, rainfall at, records of ... 458
Makawao ditch, discharge measurement ... 185
Makawao Stream, dischrage measurement ... 185
Makaweli, Hanapepe ditch near, records of flow ... 85
Olokele ditch near, records of flow ... 71–74
rainfall at, records of ... 418
temperature at, records of ... 492
Makaweli River, diversions from ... 70
near Waimea, records of flow ... 70–71
Makaweli River basin, area and position of ... 70
rainfall in ... 70
records of ... 415–416
Makaweli River basin, streams in ... 70
Makea Stream, miscellaneous discharge measurements ... 391
Makee Sugar Co., assistance by ... 14
Makoewai Stream, diversion flume from, discharge measurement ... 390
Makoewai Stream, miscellaneous discharge measurements ... 390
Makuone-Kahana divide, rainfall on, record of ... 415
Makuone-Waialae divide, rainfall on, record of ... 415
Mana Pump, rainfall at, record of ... 416
temperature at, records of ... 492
Maniania ditch near Wailuku, records of flow of ... 222–224
Manianiaula, Waiahole Stream at, records of flow of ... 177–180
Manoa, rainfall at, records of ... 431
Manoa ditch, miscellaneous discharge measurements of ... 160
Manoa-Kailua divide, rainfall on, records of ... 431
Manoa-Pauoa divide, rainfall on, records of ... 431–432
Manoa Stream, branches of ... 152
miscellaneous discharge measurements ... 159
near Honolulu, records of flow of, at college of Hawaii ... 155–157
records of flow of, at upper end of valley ... 152–155
at Waialae road ... 157–159
Manoa Stream, East Branch, discharge measurement ... 159
Manoa Stream, Middle Branch, discharge measurement ... 159
Manoa Stream, West Branch, discharge measurement ... 159
Manoa Stream basin, miscellaneous discharge measurements in ... 159–160
position of ... 152
rainfall in, records of ... 431, 432
springs in ... 152
Manoloa Stream, miscellaneous discharge measurements ... 391
Manowaiopae Stream, miscellaneous discharge measurements ... 391
"Man's water," definition of ... 24
Manuahi Stream above confluence with Hanapepe River, discharge measurement ... 143
Martin, W. F., work of ... 13
Maui Agricultural Co., assistance by ... 14
water pumped by, monthly summary of ... 331
Maui Island, agricultural products of ... 199
area of ... 197
coral along coasts of ... 198
craters of ... 198
forestation on ... 198
gaging stations on, list of ... 33–35
map of, showing location of gaging stations ... End of volume.
position of ... 197
rainfall on ... 198
records of ... 443–460
roads on ... 199
shore line of ... 198
streams of ... 198
list of ... 507–508
temperature on, records of ... 494
towns on ... 199
Maui Island, East, age of ... 198
canyons of ... 198
Ditch country of, records of flow in ... 260–330

Page.

Maui Island, Ditch country of, water supply of 259
forestation on 198
pumped water on, monthly summary of 331–332
pumping plants on, miscellaneous measurements of 331
rainfall on 198, 259
records of 443
streams, ditches, and pumping plants on, miscellaneous discharge measurements 330–331
streams of, character of 259
list of 507–508
topography of 198
Maui Island, West, age of 197
canyons of 197
erosion on 197
pumped water on 258
rainfall on 198
records of 256–258
streams and ditches of, miscellaneous measurements of 256–258
streams of, list of 507
records of flow of 199–256
vegetation on 198
Mauka tributary of Waianae Stream, discharge measurements 173
Maulua Stream, miscellaneous discharge measurements 391
Mauna Kea, altitude of 334
features of 333–334
rainfall on 334
rainfall on eastern slope of, records of .. 465–468
rainfall on northern slope of, records of .. 471–475
streams on 334
records of flow of 336–389
Mauna Loa, altitude of 334
craters of 334–335
features of 334–335
Maunawili ditch, discharge measurement 185
Maunawili ranch, rainfall at, records of 442
McBryde ditch, discharge measurement 144
McBryde Sugar Co. (Ltd.), assistance by 14
McCandless, L. L., assistance by 14
McCrosson, J. T., assistance by 14
McMaster, J. C., assistance by 14
Menefoglio, Alfred, assistance by 14
Meyer, Frederick, assistance by 14
Middle Fork. *See name of main stream.*
Miller, E. E., assistance by 14
Million gallons, definition of 24
Mill reservoir ditch near Aiea, discharge measurements 186
Miner's inch, definition of 24
Mission water head, discharge measurement. 392
Moanalua, flowing wells near, discharge measurements 189
rainfall at, records of 436
Moanalulu Stream, miscellaneous discharge measurements 391
Moaula, rainfall at, records of 461
Mohihi-Koaie divide, rainfall on, record of ... 411
Mohihi Stream near Waimea, records of flow. 52–56
Mohihi Upper Crossing, rainfall at, record of. 412
Mokihana Stream, discharge measurements .. 143

Page.

Mokupea, rainfall at, records of 452
Molokai Island, area and position of 196
population of 196
streams of 197
topography of 196
Molokoa, rainfall at, records of 423
Mountain View, rainfall at, records of 484
Mount Olympus, rainfall at, records of 431
Multiple-point methods of measuring stream flow 20
Myers, J. R., assistance by 14

N.

Naalehu, evaporation at, records of 491
rainfall at, records of 483
Nahiku, Koolau ditch near, discharge measurements 330
rainfall at, records of 454
temperature at, records of 494
Nailiilihaele Stream near Huelo, discharge measurements 330
records of flow of 298–301
Nailiilihaele weir, New Hamakua ditch at, records of flow of 318–320
Nailiilihaeleliilii Stream near Huelo, above intake of Old Hamakua ditch, discharge measurements 330
Namahana Peak, altitude of 128
Nanue Stream, miscellaneous discharge measurements 391
Nawiliwili Stream basin, rainfall in, records of 423–424
Needle, The, Iao Valley, view of, plate showing 198
New Hamakua ditch. *See* Hamakua ditch, New.
Ninole Stream, miscellaneous discharge measurements 391
Niulii, rainfall at, records of 480
Nuuanu, well in, section of 192
Nuuanu Pali, rainfall at, records of 434
Nuuanu Stream at Honolulu, records of flow of 163–164
diversions from 163
miscellaneous discharge measurements of. 168
Nuuanu Stream, East Fork, discharge measurements 168
Nuuanu Stream, West tributary, discharge measurements 168
Nuuanu Stream basin, miscellaneous discharge measurements in 168
position of 163
rainfall in 163
records of 434–435, 436

O.

Oahu Island, agricultural products of 148
area of 145
artesian water supply of 147
coral reefs of 147
evaporation on, records of 490–491
forestation of 148
gaging stations on, list of 33
map of, showing location of gaging stations .. End of volume.
mountain ranges of 145–147
population of 148

Page.

Oahu Island, position and shape of..... 145
rainfall on..... 148
records of..... 429–443
sections of wells on..... 191–193
shore line of..... 147
springs and artesian wells of..... 187–196
streams of, character of..... 148
list of..... 506–507
miscellaneous discharge measurements of..... 186
records of flow of..... 148–185
temperature on, records of..... 493
transportation facilities on..... 148
wells on..... 147
Oahu Sugar Co. (Ltd.), assistance by..... 14
water pumped by, at Waipahu, monthly summary of..... 193–194
Oanui Stream near Huelo, records of flow of..... 303–306
Okole Stream, Hawaii, discharge measurement..... 391
Olaa flume, discharge measurement..... 392
Olaa mill, rainfall at, records of..... 485
Old Kahoma ditch. See Kahoma ditch, Old.
Olinda, rainfall at, records of..... 457
Olokele ditch, miscellaneous discharge measurements of..... 144
near Makaweli, records of flow..... 71–74
rainfall at, record of..... 416
Olokele mauka, rainfall at, record of..... 416
Olokele Stream, diversions from..... 70
Olowalu, Olowalu ditch near, records of flow..... 235–236
rainfall at, records of..... 450
Ukumehame Stream near, records of flow..... 234–235
Olowalu ditch near Olowalu, records of flow of..... 235–236
Olowalu mauka, rainfall at, records of..... 449
Olowalu Stream basin, position of..... 235
rainfall in, records of..... 449–450
Olowalu Sugar Co., assistance by..... 14
Olympus, Mount, rainfall at, records of..... 431
Onomea Stream, discharge measurements..... 390
Ookala, rainfall at, records of..... 471
Oopuola Stream near Huelo, records of flow of..... 278–281
Opaeula-Anahula divide, rainfall on, records of..... 441
Opana ditch near Huelo, records of flow of.. 317–318
Opana Stream near Huelo, records of flow of. 316
Opana weir, Lowrie ditch at, records of flow of..... 326–328
Old Hamakua ditch at, records of flow of..... 322–324
Opea Stream, miscellaneous discharge measurements..... 391

P.

Paauhau mauka, rainfall at, records of..... 476
Paauhau, rainfall at, records of..... 476
Paauilo, rainfall at, records of..... 476
Pahala, rainfall at, records of..... 483
temperature at, records of..... 495
Pahoa, rainfall at, records of..... 485

Page.

Paia, water pumped at, by Maui Agricultural Co., monthly summary of..... 331
Pailolo Channel, width of..... 197
Palama ditch above Wailuku, discharge measurement..... 257
Palolo ditch near Waikapu, records of flow of..... 231–233
Palolo Stream, branches of..... 148
discharge measurement of, on lower Palolo road..... 152
diversions from..... 148
Palolo Stream basin, miscellaneous discharge measurements in..... 152
position of..... 148
rainfall in, records of..... 431
Papaa (Kulanakii) Stream, miscellaneous discharge measurements..... 391
Papaaloa, rainfall at, records of..... 470
Papaaloa Stream, discharge measurements.. 391
Papaikou, rainfall at, records of..... 468
Papaikou Stream, miscellaneous discharge measurements..... 390
Parker Stream, discharge measurements..... 184
Paukahana, rainfall at, record of..... 411
Pauoa ditch, discharge measurements..... 163
Pauoa-Manoa divide, rainfall on, records of.. 432
Pauoa Stream, miscellaneous discharge measurements of..... 163
near Honolulu, records of flow of..... 160–162
Pauoa Stream basin, miscellaneous discharge measurements in..... 163
position of..... 160
springs in..... 160
Peahi weir, Haiku ditch at, records of flow of..... 328–330
Pearl Harbor, springs around, miscellaneous measurements..... 190
wells around, miscellaneous measurements..... 190–191
Penhallow, H. B., assistance by..... 14
Pepeekeo, Kawainui River near, flume and trestle across, plate showing view of..... 346
Kawainui River near, records of flow of.. 345
rainfall at, records of..... 469
Pepeekeo Stream, miscellaneous discharge measurements..... 390
Pierce, C. H., work of..... 13
Piilani ditch near Lahaina, discharge measurement..... 257
Pioneer Mill Co., assistance by..... 14
monthly summary of water pumped by, at Lahaina..... 258
Pipe ditch near Kapaa, records of flow of, at Kapahi..... 123–125
Pogue, W. F., assistance by..... 14
Pohakunanaka Stream, miscellaneous discharge measurements..... 390
Pohakupili, rainfall at, records of..... 426
Pohakupuka Stream, miscellaneous discharge measurements..... 391
Poomau River, head of Waimea River..... 39
Poopoo Stream, miscellaneous discharge measurements..... 391
Poowaiomahaihai ditch near Waimea, records of flow..... 75–76

Page.

Power ditch (diversion from Kealia River), miscellaneous discharge measurements of 144
Price current meters, view of, plate showing. 20
Princeville Plantation Co. (Ltd.), assistance by 14
Puakea ranch, rainfall at, records of 481
Public Land Department, assistance by 13
Public Works Department, assistance by 13
Pueo, rainfall at, records of 426
Pukele Stream near Mahoe Springs, discharge measurement 152
Waiomao Stream above, records of flow of 149–151
Pukihae Stream, miscellaneous discharge measurements 390
Pumping plants, East Maui, miscellaneous measurements of 331
West Maui, miscellaneous measurements of 258
Punahoa, Hilo water reservation at, discharge measurement 392
Mission water head at, discharge measurement 392
Punaluu, rainfall at, records of 456
spring at, flow of 408
Punaluu Stream above diversions, discharge measurements 177
near Hauula, records of flow of 176
Punaluu Stream basin, miscellaneous measurements in 177
position of 176
Punchbowl reservoir, evaporation at, records of 491
Puohakamoa Stream near Huelo, records of flow of 271–273
Pupukea, rainfall at, records of 441
Putnam, A. B., assistance by 14
Puu Alaea Stream, miscellaneous discharge measurements 391
Puu Eu Peak, altitude of 111, 128
Puuhi, rainfall at, records of 422
Puu Kihe, rainfall at, records of 471
Puu Kukui Mountain, altitude of 197
rainfall on, records of 450, 451
Puuloa, rainfall at, records of 437
Puuloa ditch near Aiea, discharge measurements 186
Puu Lua, evaporation at, records of 488
rainfall at, record of 414
Puu Moi Stream, miscellaneous discharge measurements 390
Puunene, rainfall at, records of 459
water pumped at, by Hawaiian Commercial & Sugar Co., monthly summary of 332
Puuohua Stream, miscellaneous discharge measurements 391
Puu Olii Stream, discharge measurement 391
Puuomalei, Kaluanui ditch at, records of flow of 324–326
rainfall at, records of 458
Puu Oo, rainfall at, records of 463
Puuwaawaa, rainfall at, records of 481

R.

Page.

Rainfall, methods of procuring records of 408–409
records of, on Hawaii Island 462–486
on Kahoolawe Island 443, 460–461
on Kauai Island 409–429
on Maui Island 443–460
on Oahu Island 429–443
Rainfall stations, lists of, Hawaii Island 462, 486
lists of, Kauai Island 429
Maui and Kahoolawe Islands 444, 461
Oahu Island 430, 443
Rain gages, types of 408–409
types of, view of, plate showing 408
Rating curves, construction of 26
Rating tables, application of, assumptions concerning 26
Renton, G. F., assistance by 14
Rice, C. A., assistance by 14
Rice, cultivation of, view of, plate showing 14
Rice ditch near Kapaa, discharge measurement 144
Robertson, G. H., assistance by 13
Run-off in inches, definition of 24

S.

Sanborn, W. F., assistance by 14
Schnack, A. G., work of 13
Schofield Barracks, rainfall at, records of 438
temperature at, records of 493
Schulz, H. R., work of 13
Scott, John A., assistance by 14
Searle, R. C., assistance by 14
Second-feet per square mile, definition of 24
Second-foot, definition of 23
Sedgwick, T. F., assistance by 14
Single-point methods of measuring stream flow 21
South Fork. See name of main stream.
Spalding, R. P., assistance by 14
Spreckels ditch, head of 268
near Huelo, miscellaneous discharge measurements 330
records of flow of, at station No. 1 281–283
at station No. 2 284
at station No. 3 285–287
at station No. 4 287–289
at station No. 5 290–291
at station No. 6 291–292
at station No. 7 292–293
at station No. 8 293–294
near Waihee, records of flow of 206–208
near Wailuku, records of flow of, at Waiale weir 208–210
Spreckels ditch region, rainfall in, records of 455, 456
streams and ditches in, records of flow of 268–294
streams in 268
Spreckelsville, rainfall at, records of 459
Stewart, J. B., work of 13
Stockman, William B., assistance by 13
Stodart, William, assistance by 14
Stream flow, field methods used in measuring 16–23
multiple-point methods of measuring 20
office methods of computing and studying 26–29

Page.
Stream flow, single-point methods of measuring ... 21
units of measurement of, definition of ... 23–24
velocity-area measurements of ... 19–23
vertical integration method of measuring. 21
vertical velocity curve method of measuring ... 20
weir measurements of ... 17–18
Sugar cane and irrigation ditch, view of, plate showing ... 14
Summit Camp, rainfall at, records of ... 425
Survey Department, assistance by ... 13
Swanzy, F. M., assistance by ... 13

T.

Tables, explanation of ... 29–31
Tantalus (Isenberg), rainfall at, records of ... 431
Tantalus, temperature at, records of ... 493
Taro, cultivation of, view of, plate showing .. 15
Temperature records, Hawaii Islands ... 493
Kauai Island ... 492–493
Oahu Island ... 493
variations in ... 491–492
Templeton, W. M., assistance by ... 14
Tenney, E. D., assistance by ... 13
Terms, definition of ... 23–24
Tripp, George, assistance by ... 14
Tucker, J. D., assistance by ... 13
Tunnel ditch near Kapaa, records of flow of, at Kapahi ... 118–120

U.

Uhakauwai Stream near Hilo, discharge measurements ... 390
Ukulele, rainfall at, records of ... 457
Ukumehame Stream near Olowalu, records of flow of ... 234–235
Ukumehame Stream basin, position of ... 234
Umikoa ranch, rainfall at, records of ... 473–474
Units of measurements of stream flow ... 23–24
Uwau Stream above mouth, discharge measurements ... 183

V.

Velocity, determination of ... 19–22
Velocity, position of thread of mean ... 21
Velocity-area gaging station, view of, plate showing ... 16
Velocity-area measurements, methods used in 19–23
Vertical integration method of measuring stream flow ... 21
Vertical velocity curve method of measuring stream flow ... 20
Volcano House, rainfall at, records of ... 484

W.

Wading stations, measurements at ... 22
Wahiawa, North Fork of Kaukonahua Stream near, records of flow of ... 170
Wahiawa, rainfall at, records of ... 440
reservoir ditch near, discharge measurements ... 186
records of flow of ... 171–172
South Fork of Kaukonahua Stream near, records of flow of ... 169–170
Wahiawa reservoir ditch, gaging station on, view of, plate showing ... 16
miscellaneous discharge measurements .. 186
near Wahiawa, records of flow of ... 171–172

Page.
Wahiawa Stream basin, rainfall in, records of ... 419–420
Wahiawa Water Co. (ltd.), assistance by ... 14
Waiaama Stream, miscellaneous discharge measurements ... 390
Waiahi, rainfall at, records of ... 425
Waiahole, Waiahole Stream at, records of flow of ... 180–181
Waiahole Stream, branches of ... 178
ditches from, miscellaneous discharge measurements ... 183–184
gaging station on, view of, plate showing. 16
miscellaneous discharge measurements of. 183
near Waikane, records of flow of, at Manianiaula ... 178–180
records of flow of, at Waiahole ... 180–181
Waiahole Stream basin, miscellaneous discharge measurements in ... 183–184
position of ... 178
Waiahole-Waiawa divide, rainfall on, records of ... 438
Waiaka bridge, Kekaha ditch near, discharge measurements ... 144
Waiakea mill, rainfall at, records of ... 465
Waiakoali camp, evaporation at, records of .. 457
rainfall and evaporation station at, view of, plate showing ... 346
rainfall at, record of ... 413
Waiakoali Stream near Waimea, records of flow ... 48–52
Waialae-Makuone divide, rainfall on, record of ... 415
Waialae Stream above confluence with Waimea River, discharge measurement ... 143
near Waimea, rainfall at, record of ... 414
records of flow ... 56–59
unnamed tributary of, discharge measurement ... 143
Waiale weir, Spreckels ditch at, records of flow of ... 208–210
Waialeale Mountain, altitude of ... 36
rainfall on, record of ... 415
Waialua, rainfall at, records of ... 414
Waialua, water pumped at, by Waialua Agricultural Co., monthly summary of ... 195–196
Waialua Agricultural Co., assistance by ... 14
water pumped by, monthly summary of ... 195–196
Waialua mill, rainfall at, records of ... 440
Waianae, temperature at, records of ... 493
Waianae Co., assistance by ... 14
Waianae mauka, rainfall at, records of ... 439
Waianae Mill, rainfall at, records of ... 440
Waianae Mountains, area of ... 145
erosion of ... 145
Waianae Stream, discharge measurements, miscellaneous ... 173
Waianae Stream, West Fork, discharge measurements ... 173
Waianae Stream basin, miscellaneous discharge measurements in ... 173
position of ... 173
rainfall in, records of ... 439
Waianu ditches, miscellaneous discharge measurements ... 186

Page.

Waianu Stream, ditches from, discharge measurements 183
miscellaneous discharge measurements 183
near Waikane, records of flow of 182
Waianu Stream, Middle Fork, discharge measurements 183
Waianu Stream, North Fork, discharge measurements 183
Waianu Stream, South Fork, discharge measurements 183
Waianu Stream basin, miscellaneous discharge measurements in 183
Waiapele Lake, features of 335
Waiawaawa reservoir, Maiakii Stream above, discharge measurement 143
Waiawa, evaporation at, records of 488
rainfall at, record of 416, 438
Waiawa ditch, discharge measurements 186
Waiawa Stream basin, rainfall in, records of 438
Waiawa-Waiahole divide, rainfall on, records of 438
Waiehu, Maui, rainfall at, records of 445
Waiehu ditch near Wailuku, Maui, records of flow of 212–215
Waiehu Falls, Kaui Island, South Fork of Wailua River above, records of flow 94–95
view of, plate showing 38
Waiehu Stream, Hawaii, discharge measurements 391
Waiehu Stream, Maui Island, branches of 210
diversions from 210
Waiehu Stream, North, Maui Island, near Wailuku, records of flow of 211–212
Waiehu Stream, South, Maui Island, near Wailuku, discharge measurement 256
near Wailuku, records of flow of 215–217
Waiehu Stream basin, Maui, position and area of 210
Waihee, Maui, Kapuna ditch (north side) above, discharge measurements 257
rainfall at, records of 445
Spreckels ditch near, records of flow of 206–208
Waihee canal near, miscellaneous discharge measurements 257
records of flow of 202–204
Waihee Stream near, records of flow of 199–202
Waihee canal near Waihee, Maui, miscellaneous discharge measurements 257
near Waihee, Maui, records of flow of 202–204
near Wailuku, Maui, discharge measurements 257
records of flow of 205–206
Waihee Stream, diversions from 199
near Waihee, discharge measurement 256
records of flow of 199–202
Waihee Stream basin, area of 199
position of 199
rainfall in 199
records of 444–445
Waihee tunnels, Upper and Lower, above Waihee, discharge measurements 258
Waihee water development tunnel, rainfall at, records of 444
Waihi Stream, miscellaneous discharge measurements of 183, 186
near Waikane, records of flow of 181

Page.

Waihoi, rainfall at, records of 453
Waikakalaua Stream basin, rainfall in, records of 438
Waikamoi mauka, rainfall at, records of 456
Waikamoi, rainfall at, records of 456
Waikamoi Stream near Huelo, records of flow of 276–278
Waikane, Halona Stream near, records of flow of 182
Waiahole Stream near, records of flow of 178–181
Waianu Stream near, records of flow of 182
Waihi Stream near, records of flow of 181
Waikane ditch, discharge measurements 186
Waikane Stream, discharge measurements 178
diversions from, discharge measurements 178
Waikane Stream basin, miscellaneous discharge measurements in 178
position of 177
Waikapu, Palolo ditch near, records of flow of 231–233
rainfall at, records of 449
South-Side Waikapu ditch near, records of flow of 228–230
Waikapu Stream near, discharge measurements 256
records of flow of 225–227
Waikapu ditch, South Side, near Waikapu, records of flow of 228–230
Waikapu Stream near Waikapu, miscellaneous discharge measurements 256
records of flow of 225–227
Waikapu Stream basin, features of 225
rainfall in, records of 448–449
Waikapu tunnel No. 1 near Waikapu, discharge measurement 258
Waikapu water development tunnel, rainfall at, records of 448
Waikaumalo, rainfall at, records of 470
Waikaumalo Stream, miscellaneous discharge measurements 391
Waikoko Stream, discharge measurement 143
Waikolo Stream, discharge measurements 391
Wailua River, Kaui, branches of 90
diversions from 90–91
Wailua River, North Fork, divide between Hanalei River and, rainfall on, records of 425
divide between Kapaa River and, rainfall on, records of 426
near Lihue, diagram showing fluctuations in stage of 102
records of flow 101–105
view of, plate showing 19
Wailua River, South Fork of falls on, plate showing view of 38
near Lihue, records of flow above Waiehu Falls 94–95
records of flow at siphon 91–94
Wailua River basin, Kaui, extent and position of 90
rainfall in 90
records of 425
storage sites in 91
topography of 90
Wailua Stream, Hawaii, miscellaneous discharge measurements 391

Page.

Wailuku, Maui, Culvert Creek near, discharge measurement 256
ditches above, miscellaneous discharge measurements 257
Iao Stream near, discharge measurements above and below gaging station 256
records of flow of 218–221
Iao tunnels near, discharge measurements 258
Kalana Auwai ditch above, discharge measurement 257
Kama Auwai ditch above, discharge measurements 257
Maniania ditch near, records of flow of 222–224
Wailuku mill, rainfall at, records of 448
Wailuku mission, rainfall at, records of 447
North Waiehu ditch near, records of flow of 212–215
North Waiehu Stream near, records of flow of 211–212
Palama ditch above, discharge measurement 257
rainfall at, records of 447
South Waiehu Stream near, discharge measurement 256
records of flow of 215–217
Spreckels ditch near, records of flow of 208–210
temperature at, records of 494
Waihee canal near, discharge measurements 257
records of flow of 205–206
Walbridge ditch above, discharge measurement 257
Wailuku River basin, Hawaii, features of 337
Wailuku River, Hawaii, diversions from 337
near Hilo, discharge, area, and mean velocity curves for 339
minimum discharge of 347
records of flow of 337–340
tributaries of 337
combined flow of 347
view of, plate showing 334
Wailuku Sugar Co., assistance by 14
Waima, New Hamakua ditch at, records of flow of 395
Waipio River below, records of flow of 394–395
Waima Stream near Waipio, records of flow of 402
Waimalino Stream, miscellaneous discharge measurements 391
Waimalu, rainfall at, records of 437
Waimalu ditch, discharge measurements 186
Waimalu Stream above all ditches, discharge measurement 186
Waimalu Stream basin, rainfall at, records of 437
Waimalu-uka, rainfall at, records of 437
Waimanalo, rainfall at, records of 443
Waimanalo ditch, capacity of 185
Waimanalo reservoir, Kailua ditch above, discharge measurements 185
springs and ditches above, discharge measurements 185
Waimanalo Stream basin, miscellaneous discharge measurements in 185
position of 185

Page.

Waimanalo Stream basin, water diverted to, from Kailua Stream basin 185
Waimea, Hawaii, rainfall at, records of 479
temperature at, records of 495
Waimea, Kaui, Kamenehune ditch near, records of flow 68–69
Kawaikoi Stream near, records of flow 43–48
Kekaha ditch near, records of flow 59–67
Makaweli River near, records of flow 70–71
Mohihi Stream near, records of flow 52–56
Poowaiomahaihai ditch near, records of flow 75–76
rainfall at camp No. 7 near, record of 417
Waiakoali Stream near, records of flow 48–52
Waialae Stream near, records of flow 56–59
Waimea ditch near 67–68
Waimea River near, records of flow 40–43
Waimea Canyon, features of 37
rainfall near, record of 414
Waimea ditch near Waimea, Kaui 67–68
Waimea River, Kaui, above confluence with Koaie Stream, discharge measurement 143
Waimea River basin, Kaui, area of 39
rainfall in 39
records of 411–414
streams in 39
Waimea River, near Waimea, Kaui, records of flow 40–43
Waialae Stream above confluence, with discharge measurement 143
Waimea Sugar Mill Co. (Ltd.), assistance by 14
Wainaku flume, discharge measurement 392
Wainamuamu weir, near Kapaa, records of flow over 109
position of 107
Wainiha, Wainiha canal near, records of flow 139–142
Wainiha River near, records of flow 139
Wainiha and Waimea rivers, divide between, record of rainfall on 410
Wainiha canal, near Wainiha, records of flow of, at intake 139–140
records of flow of, at tailrace 142
at tunnel No. 18 141–142
rainfall at intake of, records of 428
streams tributary to, discharge measurements 143
Wainiha ditch at gage No. 7, discharge measurement 144
Wainiha River, diversions from 139
near Wainiha, records of flow of, at power house 139
tributaries of 139
Wainiha River basin, area and position of 139
rainfall in 139
record of 428–429
Waiomao, rainfall at, records of 431
Waiomao ditch, discharge measurements 152
Waiomao Stream, miscellaneous discharge measurements of 152
near Honolulu, records of flow of 149–151
Waiopae ranch, rainfall at, records of 460
Waipa Stream, discharge measurement 143
Waipahu, Oahu, ditches near, discharge measurements 186

Page.

Waipahu, Oahu, rainfall at, records of..... 439
water pumped at, by Oahu Sugar Co., monthly summary of..... 193–194
Waipio, Hawaii, Alakahi Stream near, records of flow of..... 400–401
branches of Kawainui Stream near, records of flow of..... 399–400
Kawainui of Waipio River near, records of flow of 393, 398–399
Koiawe Stream near, records of flow of... 401
Waima Stream near, records of flow of... 402
Waipio River near, records of flow of... 394–395
Waipio, Maui, Waipio River near, records of flow of..... 298
Waipio River, Hawaii, near Waipio, records of flow of..... 394–395
use of, for irrigation..... 333
Waipio River, Maui, records of flow of..... 298
Waipio River basin, Hawaii, features of..... 392
position of..... 392
rainfall in, 1901–1902..... 398
records of..... 478–479
records of flow of in, in 1901–1902..... 397–402
springs in..... 392
streams and ditches of..... 392

Page.

Waipahoehoe Stream, diversion flume from, discharge measurements..... 390
miscellaneous discharge measurements... 390
Waipunalei Stream, discharge measurement. 402
Walbridge ditch (south side) above Wailuku discharge measurement..... 257
Wall, W. A., assistance by..... 14
Wall, W. E., assistance by..... 13
Weather Bureau, Hawaiian section, assistance by..... 13
Weinrick, William, jr., assistance by..... 14
Weinzheimer, Ludwig, assistance by..... 14
Weir gaging station, view of, plate showing.. 16
Weir measurements, accuracy of results of... 17–18
comparison of, with current-meter measurements..... 18
diagram showing comparison of, with current meter measurements..... 18
Weloka Stream, miscellaneous discharge measurements..... 391
Whittemore, George S., assistance by..... 14
Wilcox ditch, rainfall at, records of..... 422
Wilcox, C. H., assistance by..... 14
Wilcox, E. V., appointed member of board of allotment..... 12
Wooten, W. P., assistance by..... 14

DRAINAGE MAP OF THE ISLAND OF OAHU TERRITORY OF HAWAII

Scale 1:63,000

1 0 1 2 3 4 5 Miles

1913

- Stream gaging station
- Rainfall station
- Evaporation station
- Artesian well

Base from maps of the Hawaii Territory Survey and miscellaneous data

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

DRAINAGE MAP OF THE ISLAND OF KAUAI TERRITORY OF HAWAII

Scale 1:63,000

1913

Base from topographic sheets prepared by the U. S. Geological Survey

DRAINAGE MAP OF THE ISLANDS OF MAUI AND KAHOOLAWE TERRITORY OF HAWAII

Scale 1:63,360

1 0 1 2 3 4 5 Miles

1913

FROM REPORT OF THE GOVERNOR OF HAWAII

○ Stream gaging station
● Rainfall station

PACIFIC OCEAN

PAILOLO CHANNEL

AUAU CHANNEL

KEALAIKAHIKI CHANNEL

ALALAKEIKI CHANNEL

ALENUIHAHA CHANNEL

WEST MAUI

EAST MAUI

KAHOOLAWE

Honolua 24 Elev 25'
Honokahua Gulch Elev 760' 23
Honokahua diversion intake 25 Elev 805'
Mokapea 22 Elev 1,000'
Makamu 21 Elev 1,800'
Honokawai Power House 19
Honokawai Gulch 18
Kuampah 20 Elev 12'
Puu Kukui slope 17 Elev 2,500'
Kahoma reservoir 16 Elev 2,000'
Puu Kukui 15 Elev 5,000'
Lahaina
Lahainaluna
Honokawai Elev 1200'
Honokawai Str. Elev 1500'
Honokahua
Honokahua Stream
Honokohau Stream
Honokohau Ditch
Honokawai
Honokawai Ditch
Wahikuli Gulch
Wahikuli Stream
Kahoma Stream
Lahainaluna Stream
Kauaula Stream
Launiupoko Stream
Olowalu 14 Elev 0'
Olowalu Pumping Plant
Olowalu Ditch
Ukumehame Gulch
Manawainui Gulch
Ekc Elev 4,500'
Waihee Tunnels 1 Elev 1,550'
Waihee 2 Elev 100'
Waihee Str.
Waihee Ditch
Waiehu 3 Elev 375'
N. Waiehu Stream
S. Waiehu Ditch
Waiehu Mission 8 Elev 250'
Waiehu Mill 9 Elev 80'
Waiehu Canal
Kahului Harbor
10 Kahului Elev 8'
Iao Valley, tableland 5 Elev 1,500'
Iao Valley cone Elev 1,720'
Iao Valley, gaging station 6 Elev 830'
IAO VALLEY
Waikapu Tunnels 11 Elev 1,535'
Waikapu 12 Elev 600'
Waikapu Stream
Waihee Ditch
Waiehu Ditch
Waiehu Canal
Waihee Pumping Plant
Waihee Power House
Waihee Power Line
Waihee Pipe Line
Waihee Reservoir No. 2
Waihee Reservoir No. 3
Waihee Reservoir No. 4
Waihee Reservoir No. 5
Waihee Reservoir No. 6
Waihee Reservoir No. 7
Waihee Reservoir No. 8
Waihee Reservoir No. 9
Waihee Reservoir No. 10
Waihee Reservoir No. 11
Waihee Reservoir No. 12
Waihee Reservoir No. 13
Waihee Reservoir No. 14
Waihee Reservoir No. 15
Waihee Reservoir No. 16
Waihee Reservoir No. 17
Waihee Reservoir No. 18
Waihee Reservoir No. 19
Waihee Reservoir No. 20
Waihee Reservoir No. 21
Waihee Reservoir No. 22
Waihee Reservoir No. 23
Waihee Reservoir No. 24
Waihee Reservoir No. 25
Waihee Reservoir No. 26
Waihee Reservoir No. 27
Waihee Reservoir No. 28
Waihee Reservoir No. 29
Waihee Reservoir No. 30
Waihee Reservoir No. 31
Waihee Reservoir No. 32
Waihee Reservoir No. 33
Waihee Reservoir No. 34
Waihee Reservoir No. 35
Waihee Reservoir No. 36
Waihee Reservoir No. 37
Waihee Reservoir No. 38
Waihee Reservoir No. 39
Waihee Reservoir No. 40
Waihee Reservoir No. 41
Waihee Reservoir No. 42
Waihee Reservoir No. 43
Waihee Reservoir No. 44
Waihee Reservoir No. 45
Waihee Reservoir No. 46
Waihee Reservoir No. 47
Waihee Reservoir No. 48
Waihee Reservoir No. 49
Waihee Reservoir No. 50
Waihee Reservoir No. 51
Waihee Reservoir No. 52
Waihee Reservoir No. 53
Waihee Reservoir No. 54
Waihee Reservoir No. 55
Waihee Reservoir No. 56
Waihee Reservoir No. 57
Waihee Reservoir No. 58
Waihee Reservoir No. 59
Waihee Reservoir No. 60
Waihee Reservoir No. 61
Waihee Reservoir No. 62
Waihee Reservoir No. 63
Waihee Reservoir No. 64
Waihee Reservoir No. 65
Waihee Reservoir No. 66
Waihee Reservoir No. 67
Waihee Reservoir No. 68
Waihee Reservoir No. 69
Waihee Reservoir No. 70
Waihee Reservoir No. 71
Waihee Reservoir No. 72
Waihee Reservoir No. 73
Waihee Reservoir No. 74
Waihee Reservoir No. 75
Waihee Reservoir No. 76
Waihee Reservoir No. 77
Waihee Reservoir No. 78
Waihee Reservoir No. 79
Waihee Reservoir No. 80
Waihee Reservoir No. 81
Waihee Reservoir No. 82
Waihee Reservoir No. 83
Waihee Reservoir No. 84
Waihee Reservoir No. 85
Waihee Reservoir No. 86
Waihee Reservoir No. 87
Waihee Reservoir No. 88
Waihee Reservoir No. 89
Waihee Reservoir No. 90
Waihee Reservoir No. 91
Waihee Reservoir No. 92
Waihee Reservoir No. 93
Waihee Reservoir No. 94
Waihee Reservoir No. 95
Waihee Reservoir No. 96
Waihee Reservoir No. 97
Waihee Reservoir No. 98
Waihee Reservoir No. 99
Waihee Reservoir No. 100
Waihee Reservoir No. 101
Waihee Reservoir No. 102
Waihee Reservoir No. 103
Waihee Reservoir No. 104
Waihee Reservoir No. 105
Waihee Reservoir No. 106
Waihee Reservoir No. 107
Waihee Reservoir No. 108
Waihee Reservoir No. 109
Waihee Reservoir No. 110
Waihee Reservoir No. 111
Waihee Reservoir No. 112
Waihee Reservoir No. 113
Waihee Reservoir No. 114
Waihee Reservoir No. 115
Waihee Reservoir No. 116
Waihee Reservoir No. 117
Waihee Reservoir No. 118
Waihee Reservoir No. 119
Waihee Reservoir No. 120
Waihee Reservoir No. 121
Waihee Reservoir No. 122
Waihee Reservoir No. 123
Waihee Reservoir No. 124
Waihee Reservoir No. 125
Waihee Reservoir No. 126
Waihee Reservoir No. 127
Waihee Reservoir No. 128
Waihee Reservoir No. 129
Waihee Reservoir No. 130
Waihee Reservoir No. 131
Waihee Reservoir No. 132
Waihee Reservoir No. 133
Waihee Reservoir No. 134
Waihee Reservoir No. 135
Waihee Reservoir No. 136
Waihee Reservoir No. 137
Waihee Reservoir No. 138
Waihee Reservoir No. 139
Waihee Reservoir No. 140
Waihee Reservoir No. 141
Waihee Reservoir No. 142
Waihee Reservoir No. 143
Waihee Reservoir No. 144
Waihee Reservoir No. 145
Waihee Reservoir No. 146
Waihee Reservoir No. 147
Waihee Reservoir No. 148
Waihee Reservoir No. 149
Waihee Reservoir No. 150
Waihee Reservoir No. 151
Waihee Reservoir No. 152
Waihee Reservoir No. 153
Waihee Reservoir No. 154
Waihee Reservoir No. 155
Waihee Reservoir No. 156
Waihee Reservoir No. 157
Waihee Reservoir No. 158
Waihee Reservoir No. 159
Waihee Reservoir No. 160
Waihee Reservoir No. 161
Waihee Reservoir No. 162
Waihee Reservoir No. 163
Waihee Reservoir No. 164
Waihee Reservoir No. 165
Waihee Reservoir No. 166
Waihee Reservoir No. 167
Waihee Reservoir No. 168
Waihee Reservoir No. 169
Waihee Reservoir No. 170
Waihee Reservoir No. 171
Waihee Reservoir No. 172
Waihee Reservoir No. 173
Waihee Reservoir No. 174
Waihee Reservoir No. 175
Waihee Reservoir No. 176
Waihee Reservoir No. 177
Waihee Reservoir No. 178
Waihee Reservoir No. 179
Waihee Reservoir No. 180
Waihee Reservoir No. 181
Waihee Reservoir No. 182
Waihee Reservoir No. 183
Waihee Reservoir No. 184
Waihee Reservoir No. 185
Waihee Reservoir No. 186
Waihee Reservoir No. 187
Waihee Reservoir No. 188
Waihee Reservoir No. 189
Waihee Reservoir No. 190
Waihee Reservoir No. 191
Waihee Reservoir No. 192
Waihee Reservoir No. 193
Waihee Reservoir No. 194
Waihee Reservoir No. 195
Waihee Reservoir No. 196
Waihee Reservoir No. 197
Waihee Reservoir No. 198
Waihee Reservoir No. 199
Waihee Reservoir No. 200
Waihee Reservoir No. 201
Waihee Reservoir No. 202
Waihee Reservoir No. 203
Waihee Reservoir No. 204
Waihee Reservoir No. 205
Waihee Reservoir No. 206
Waihee Reservoir No. 207
Waihee Reservoir No. 208
Waihee Reservoir No. 209
Waihee Reservoir No. 210
Waihee Reservoir No. 211
Waihee Reservoir No. 212
Waihee Reservoir No. 213
Waihee Reservoir No. 214
Waihee Reservoir No. 215
Waihee Reservoir No. 216
Waihee Reservoir No. 217
Waihee Reservoir No. 218
Waihee Reservoir No. 219
Waihee Reservoir No. 220
Waihee Reservoir No. 221
Waihee Reservoir No. 222
Waihee Reservoir No. 223
Waihee Reservoir No. 224
Waihee Reservoir No. 225
Waihee Reservoir No. 226
Waihee Reservoir No. 227
Waihee Reservoir No. 228
Waihee Reservoir No. 229
Waihee Reservoir No. 230
Waihee Reservoir No. 231
Waihee Reservoir No. 232
Waihee Reservoir No. 233
Waihee Reservoir No. 234
Waihee Reservoir No. 235
Waihee Reservoir No. 236
Waihee Reservoir No. 237
Waihee Reservoir No. 238
Waihee Reservoir No. 239
Waihee Reservoir No. 240
Waihee Reservoir No. 241
Waihee Reservoir No. 242
Waihee Reservoir No. 243
Waihee Reservoir No. 244
Waihee Reservoir No. 245
Waihee Reservoir No. 246
Waihee Reservoir No. 247
Waihee Reservoir No. 248
Waihee Reservoir No. 249
Waihee Reservoir No. 250
Waihee Reservoir No. 251
Waihee Reservoir No. 252
Waihee Reservoir No. 253
Waihee Reservoir No. 254
Waihee Reservoir No. 255
Waihee Reservoir No. 256
Waihee Reservoir No. 257
Waihee Reservoir No. 258
Waihee Reservoir No. 259
Waihee Reservoir No. 260
Waihee Reservoir No. 261
Waihee Reservoir No. 262
Waihee Reservoir No. 263
Waihee Reservoir No. 264
Waihee Reservoir No. 265
Waihee Reservoir No. 266
Waihee Reservoir No. 267
Waihee Reservoir No. 268
Waihee Reservoir No. 269
Waihee Reservoir No. 270
Waihee Reservoir No. 271
Waihee Reservoir No. 272
Waihee Reservoir No. 273
Waihee Reservoir No. 274
Waihee Reservoir No. 275
Waihee Reservoir No. 276
Waihee Reservoir No. 277
Waihee Reservoir No. 278
Waihee Reservoir No. 279
Waihee Reservoir No. 280
Waihee Reservoir No. 281
Waihee Reservoir No. 282
Waihee Reservoir No. 283
Waihee Reservoir No. 284
Waihee Reservoir No. 285
Waihee Reservoir No. 286
Waihee Reservoir No. 287
Waihee Reservoir No. 288
Waihee Reservoir No. 289
Waihee Reservoir No. 290
Waihee Reservoir No. 291
Waihee Reservoir No. 292
Waihee Reservoir No. 293
Waihee Reservoir No. 294
Waihee Reservoir No. 295
Waihee Reservoir No. 296
Waihee Reservoir No. 297
Waihee Reservoir No. 298
Waihee Reservoir No. 299
Waihee Reservoir No. 300
Waihee Reservoir No. 301
Waihee Reservoir No. 302
Waihee Reservoir No. 303
Waihee Reservoir No. 304
Waihee Reservoir No. 305
Waihee Reservoir No. 306
Waihee Reservoir No. 307
Waihee Reservoir No. 308
Waihee Reservoir No. 309
Waihee Reservoir No. 310
Waihee Reservoir No. 311
Waihee Reservoir No. 312
Waihee Reservoir No. 313
Waihee Reservoir No. 314
Waihee Reservoir No. 315
Waihee Reservoir No. 316
Waihee Reservoir No. 317
Waihee Reservoir No. 318
Waihee Reservoir No. 319
Waihee Reservoir No. 320
Waihee Reservoir No. 321
Waihee Reservoir No. 322
Waihee Reservoir No. 323
Waihee Reservoir No. 324
Waihee Reservoir No. 325
Waihee Reservoir No. 326
Waihee Reservoir No. 327
Waihee Reservoir No. 328
Waihee Reservoir No. 329
Waihee Reservoir No. 330
Waihee Reservoir No. 331
Waihee Reservoir No. 332
Waihee Reservoir No. 333
Waihee Reservoir No. 334
Waihee Reservoir No. 335
Waihee Reservoir No. 336
Waihee Reservoir No. 337
Waihee Reservoir No. 338
Waihee Reservoir No. 339
Waihee Reservoir No. 340
Waihee Reservoir No. 341
Waihee Reservoir No. 342
Waihee Reservoir No. 343
Waihee Reservoir No. 344
Waihee Reservoir No. 345
Waihee Reservoir No. 346
Waihee Reservoir No. 347
Waihee Reservoir No. 348
Waihee Reservoir No. 349
Waihee Reservoir No. 350
Waihee Reservoir No. 351
Waihee Reservoir No. 352
Waihee Reservoir No. 353
Waihee Reservoir No. 354
Waihee Reservoir No. 355
Waihee Reservoir No. 356
Waihee Reservoir No. 357
Waihee Reservoir No. 358
Waihee Reservoir No. 359
Waihee Reservoir No. 360
Waihee Reservoir No. 361
Waihee Reservoir No. 362
Waihee Reservoir No. 363
Waihee Reservoir No. 364
Waihee Reservoir No. 365
Waihee Reservoir No. 366
Waihee Reservoir No. 367
Waihee Reservoir No. 368
Waihee Reservoir No. 369
Waihee Reservoir No. 370
Waihee Reservoir No. 371
Waihee Reservoir No. 372
Waihee Reservoir No. 373
Waihee Reservoir No. 374
Waihee Reservoir No. 375
Waihee Reservoir No. 376
Waihee Reservoir No. 377
Waihee Reservoir No. 378
Waihee Reservoir No. 379
Waihee Reservoir No. 380
Waihee Reservoir No. 381
Waihee Reservoir No. 382
Waihee Reservoir No. 383
Waihee Reservoir No. 384
Waihee Reservoir No. 385
Waihee Reservoir No. 386
Waihee Reservoir No. 387
Waihee Reservoir No. 388
Waihee Reservoir No. 389
Waihee Reservoir No. 390
Waihee Reservoir No. 391
Waihee Reservoir No. 392
Waihee Reservoir No. 393
Waihee Reservoir No. 394
Waihee Reservoir No. 395
Waihee Reservoir No. 396
Waihee Reservoir No. 397
Waihee Reservoir No. 398
Waihee Reservoir No. 399
Waihee Reservoir No. 400
Waihee Reservoir No. 401
Waihee Reservoir No. 402
Waihee Reservoir No. 403
Waihee Reservoir No. 404
Waihee Reservoir No. 405
Waihee Reservoir No. 406
Waihee Reservoir No. 407
Waihee Reservoir No. 408
Waihee Reservoir No. 409
Waihee Reservoir No. 410
Waihee Reservoir No. 411
Waihee Reservoir No. 412
Waihee Reservoir No. 413
Waihee Reservoir No. 414
Waihee Reservoir No. 415
Waihee Reservoir No. 416
Waihee Reservoir No. 417
Waihee Reservoir No. 418
Waihee Reservoir No. 419
Waihee Reservoir No. 420
Waihee Reservoir No. 421
Waihee Reservoir No. 422
Waihee Reservoir No. 423
Waihee Reservoir No. 424
Waihee Reservoir No. 425
Waihee Reservoir No. 426
Waihee Reservoir No. 427
Waihee Reservoir No. 428
Waihee Reservoir No. 429
Waihee Reservoir No. 430
Waihee Reservoir No. 431
Waihee Reservoir No. 432
Waihee Reservoir No. 433
Waihee Reservoir No. 434
Waihee Reservoir No. 435
Waihee Reservoir No. 436
Waihee Reservoir No. 437
Waihee Reservoir No. 438
Waihee Reservoir No. 439
Waihee Reservoir No. 440
Waihee Reservoir No. 441
Waihee Reservoir No. 442
Waihee Reservoir No. 443
Waihee Reservoir No. 444
Waihee Reservoir No. 445
Waihee Reservoir No. 446
Waihee Reservoir No. 447
Waihee Reservoir No. 448
Waihee Reservoir No. 449
Waihee Reservoir No. 450
Waihee Reservoir No. 451
Waihee Reservoir No. 452
Waihee Reservoir No. 453
Waihee Reservoir No. 454
Waihee Reservoir No. 455
Waihee Reservoir No. 456
Waihee Reservoir No. 457
Waihee Reservoir No. 458
Waihee Reservoir No. 459
Waihee Reservoir No. 460
Waihee Reservoir No. 461
Waihee Reservoir No. 462
Waihee Reservoir No. 463
Waihee Reservoir No. 464
Waihee Reservoir No. 465
Waihee Reservoir No. 466
Waihee Reservoir No. 467
Waihee Reservoir No. 468
Waihee Reservoir No. 469
Waihee Reservoir No. 470
Waihee Reservoir No. 471
Waihee Reservoir No. 472
Waihee Reservoir No. 473
Waihee Reservoir No. 474
Waihee Reservoir No. 475
Waihee Reservoir No. 476
Waihee Reservoir No. 477
Waihee Reservoir No. 478
Waihee Reservoir No. 479
Waihee Reservoir No. 480
Waihee Reservoir No. 481
Waihee Reservoir No. 482
Waihee Reservoir No. 483
Waihee Reservoir No. 484
Waihee Reservoir No. 485
Waihee Reservoir No. 486
Waihee Reservoir No. 487
Waihee Reservoir No. 488
Waihee Reservoir No. 489
Waihee Reservoir No. 490
Waihee Reservoir No. 491
Waihee Reservoir No. 492
Waihee Reservoir No. 493
Waihee Reservoir No. 494
Waihee Reservoir No. 495
Waihee Reservoir No. 496
Waihee Reservoir No. 497
Waihee Reservoir No. 498
Waihee Reservoir No. 499
Waihee Reservoir No. 500
Waihee Reservoir No. 501
Waihee Reservoir No. 502
Waihee Reservoir No. 503
Waihee Reservoir No. 504
Waihee Reservoir No. 505
Waihee Reservoir No. 506
Waihee Reservoir No. 507
Waihee Reservoir No. 508
Waihee Reservoir No. 509
Waihee Reservoir No. 510
Waihee Reservoir No. 511
Waihee Reservoir No. 512
Waihee Reservoir No. 513
Waihee Reservoir No. 514
Waihee Reservoir No. 515
Waihee Reservoir No. 516
Waihee Reservoir No. 517
Waihee Reservoir No. 518
Waihee Reservoir No. 519
Waihee Reservoir No. 520
Waihee Reservoir No. 521
Waihee Reservoir No. 522
Waihee Reservoir No. 523
Waihee Reservoir No. 524
Waihee Reservoir No. 525
Waihee Reservoir No. 526
Waihee Reservoir No. 527
Waihee Reservoir No. 528
Waihee Reservoir No. 529
Waihee Reservoir No. 530
Waihee Reservoir No. 531
Waihee Reservoir No. 532
Waihee Reservoir No. 533
Waihee Reservoir No. 534
Waihee Reservoir No. 535
Waihee Reservoir No. 536
Waihee Reservoir No. 537
Waihee Reservoir No. 538
Waihee Reservoir No. 539
Waihee Reservoir No. 540
Waihee Reservoir No. 541
Waihee Reservoir No. 542
Waihee Reservoir No. 543
Waihee Reservoir No. 544
Waihee Reservoir No. 545
Waihee Reservoir No. 546
Waihee Reservoir No. 547
Waihee Reservoir No. 548
Waihee Reservoir No. 549
Waihee Reservoir No. 550
Waihee Reservoir No. 551
Waihee Reservoir No. 552
Waihee Reservoir No. 553
Waihee Reservoir No. 554
Waihee Reservoir No. 555
Waihee Reservoir No. 556
Waihee Reservoir No. 557
Waihee Reservoir No. 558
Waihee Reservoir No. 559
Waihee Reservoir No. 560
Waihee Reservoir No. 561
Waihee Reservoir No. 562
Waihee Reservoir No. 563
Waihee Reservoir No. 564
Waihee Reservoir No. 565
Waihee Reservoir No. 566
Waihee Reservoir No. 567
Waihee Reservoir No. 568
Waihee Reservoir No. 569
Waihee Reservoir No. 570
Waihee Reservoir No. 571
Waihee Reservoir No. 572
Waihee Reservoir No. 573
Waihee Reservoir No. 574
Waihee Reservoir No. 575
Waihee Reservoir No. 576
Waihee Reservoir No. 577
Waihee Reservoir No. 578
Waihee Reservoir No. 579
Waihee Reservoir No. 580
Waihee Reservoir No. 581
Waihee Reservoir No. 582
Waihee Reservoir No. 583
Waihee Reservoir No. 584
Waihee Reservoir No. 585
Waihee Reservoir No. 586
Waihee Reservoir No. 587
Waihee Reservoir No. 588
Waihee Reservoir No. 589
Waihee Reservoir No. 590
Waihee Reservoir No. 591
Waihee Reservoir No. 592
Waihee Reservoir No. 593
Waihee Reservoir No. 594
Waihee Reservoir No. 595
Waihee Reservoir No. 596
Waihee Reservoir No. 597
Waihee Reservoir No. 598
Waihee Reservoir No. 599
Waihee Reservoir No. 600
Waihee Reservoir No. 601
Waihee Reservoir No. 602
Waihee Reservoir No. 603
Waihee Reservoir No. 604
Waihee Reservoir No. 605
Waihee Reservoir No. 606
Waihee Reservoir No. 607
Waihee Reservoir No. 608
Waihee Reservoir No. 609
Waihee Reservoir No. 610
Waihee Reservoir No. 611
Waihee Reservoir No. 612
Waihee Reservoir No. 613
Waihee Reservoir No. 614
Waihee Reservoir No. 615
Waihee Reservoir No. 616
Waihee Reservoir No. 617
Waihee Reservoir No. 618
Waihee Reservoir No. 619
Waihee Reservoir No. 620
Waihee Reservoir No. 621
Waihee Reservoir No. 622
Waihee Reservoir No. 623
Waihee Reservoir No. 624
Waihee Reservoir No. 625
Waihee Reservoir No. 626
Waihee Reservoir No. 627
Waihee Reservoir No. 628
Waihee Reservoir No. 629
Waihee Reservoir No. 630
Waihee Reservoir No. 631
Waihee Reservoir No. 632
Waihee Reservoir No. 633
Waihee Reservoir No. 634
Waihee Reservoir No. 635
Waihee Reservoir No. 636
Waihee Reservoir No. 637
Waihee Reservoir No. 638
Waihee Reservoir No. 639
Waihee Reservoir No. 640
Waihee Reservoir No. 641
Waihee Reservoir No. 642
Waihee Reservoir No. 643
Waihee Reservoir No. 644
Waihee Reservoir No. 645
Waihee Reservoir No. 646
Waihee Reservoir No. 647
Waihee Reservoir No. 648
Waihee Reservoir No. 649
Waihee Reservoir No. 650
Waihee Reservoir No. 651
Waihee Reservoir No. 652
Waihee Reservoir No. 653
Waihee Reservoir No. 654
Waihee Reservoir No. 655
Waihee Reservoir No. 656
Waihee Reservoir No. 657
Waihee Reservoir No. 658
Waihee Reservoir No. 659
Waihee Reservoir No. 660
Waihee Reservoir No. 661
Waihee Reservoir No. 662
Waihee Reservoir No. 663
Waihee Reservoir No. 664
Waihee Reservoir No. 665
Waihee Reservoir No. 666
Waihee Reservoir No. 667
Waihee Reservoir No. 668
Waihee Reservoir No. 669
Waihee Reservoir No. 670
Waihee Reservoir No. 671
Waihee Reservoir No. 672
Waihee Reservoir No. 673
Waihee Reservoir No. 674
Waihee Reservoir No. 675
Waihee Reservoir No. 676
Waihee Reservoir No. 677
Waihee Reservoir No. 678
Waihee Reservoir No. 679
Waihee Reservoir No. 680
Waihee Reservoir No. 681
Waihee Reservoir No. 682
Waihee Reservoir No. 683
Waihee Reservoir No. 684
Waihee Reservoir No. 685
Waihee Reservoir No. 686
Waihee Reservoir No. 687
Waihee Reservoir No. 688
Waihee Reservoir No. 689
Waihee Reservoir No. 690
Waihee Reservoir No. 691
Waihee Reservoir No. 692
Waihee Reservoir No. 693
Waihee Reservoir No. 694
Waihee Reservoir No. 695
Waihee Reservoir No. 696
Waihee Reservoir No. 697
Waihee Reservoir No. 698
Waihee Reservoir No. 699
Waihee Reservoir No. 700
Waihee Reservoir No. 701
Waihee Reservoir No. 702
Waihee Reservoir No. 703
Waihee Reservoir No. 704
Waihee Reservoir No. 705
Waihee Reservoir No. 706
Waihee Reservoir No. 707
Waihee Reservoir No. 708
Waihee Reservoir No. 709
Waihee Reservoir No. 710
Waihee Reservoir No. 711
Waihee Reservoir No. 712
Waihee Reservoir No. 713
Waihee Reservoir No. 714
Waihee Reservoir No. 715
Waihee Reservoir No. 716
Waihee Reservoir No. 717
Waihee Reservoir No. 718
Waihee Reservoir No. 719
Waihee Reservoir No. 720
Waihee Reservoir No. 721
Waihee Reservoir No. 722
Waihee Reservoir No. 723
Waihee Reservoir No. 724
Waihee Reservoir No. 725
Waihee Reservoir No. 726
Waihee Reservoir No. 727
Waihee Reservoir No. 728
Waihee Reservoir No. 729
Waihee Reservoir No. 730
Waihee Reservoir No. 731
Waihee Reservoir No. 732
Waihee Reservoir No. 733
Waihee Reservoir No. 734
Waihee Reservoir No. 735
Waihee Reservoir No. 736
Waihee Reservoir No. 737
Waihee Reservoir No. 738
Waihee Reservoir No. 739
Waihee Reservoir No. 740
Waihee Reservoir No. 741
Waihee Reservoir No. 742
Waihee Reservoir No. 743
Waihee Reservoir No. 744
Waihee Reservoir No. 745
Waihee Reservoir No. 746
Waihee Reservoir No. 747
Waihee Reservoir No. 748
Waihee Reservoir No. 749
Waihee Reservoir No. 750
Waihee Reservoir No. 751
Waihee Reservoir No. 752
Waihee Reservoir No. 753
Waihee Reservoir No. 754
Waihee Reservoir No. 755
Waihee Reservoir No. 756
Waihee Reservoir No. 757
Waihee Reservoir No. 758
Waihee Reservoir No. 759
Waihee Reservoir No. 760
Waihee Reservoir No. 761
Waihee Reservoir No. 762
Waihee Reservoir No. 763
Waihee Reservoir No. 764
Waihee Reservoir No. 765
Waihee Reservoir No. 766
Waihee Reservoir No. 767
Waihee Reservoir No. 768
Waihee Reservoir No. 769
Waihee Reservoir No. 770
Waihee Reservoir No. 771
Waihee Reservoir No. 772
Waihee Reservoir No. 773
Waihee Reservoir No. 774
Waihee Reservoir No. 775
Waihee Reservoir No. 776
Waihee Reservoir No. 777
Waihee Reservoir No. 778
Waihee Reservoir No. 779
Waihee Reservoir No. 780
Waihee Reservoir No. 781
Waihee Reservoir No. 782
Waihee Reservoir No. 783
Waihee Reservoir No. 784
Waihee Reservoir No. 785
Waihee Reservoir No. 786
Waihee Reservoir No. 787
Waihee Reservoir No. 788
Waihee Reservoir No. 789
Waihee Reservoir No. 790
Waihee Reservoir No. 791
Waihee Reservoir No. 792
Waihee Reservoir No. 793
Waihee Reservoir No. 794
Waihee Reservoir No. 795
Waihee Reservoir No. 796
Waihee Reservoir No. 797
Waihee Reservoir No. 798
Waihee Reservoir No. 799
Waihee Reservoir No. 800
Waihee Reservoir No. 801
Waihee Reservoir No. 802
Waihee Reservoir No. 803
Waihee Reservoir No. 804
Waihee Reservoir No. 805
Waihee Reservoir No. 806
Waihee Reservoir No. 807
Waihee Reservoir No. 808
Waihee Reservoir No. 809
Waihee Reservoir No. 810
Waihee Reservoir No. 811
Waihee Reservoir No. 812
Waihee Reservoir No. 813
Waihee Reservoir No. 814
Waihee Reservoir No. 815
Waihee Reservoir No. 816
Waihee Reservoir No. 817
Waihee Reservoir No. 818
Waihee Reservoir No. 819
Waihee Reservoir No. 820
Waihee Reservoir No. 821
Waihee Reservoir No. 822
Waihee Reservoir No. 823
Waihee Reservoir No. 824
Waihee Reservoir No. 825
Waihee Reservoir No. 826
Waihee Reservoir No. 827
Waihee Reservoir No. 828
Waihee Reservoir No. 829
Waihee Reservoir No. 830
Waihee Reservoir No. 831
Waihee Reservoir No. 832
Waihee Reservoir No. 833
Waihee Reservoir No. 834
Waihee Reservoir No. 835
Waihee Reservoir No. 836
Waihee Reservoir No. 837
Waihee Reservoir No. 838
Waihee Reservoir No. 839
Waihee Reservoir No. 840
Waihee Reservoir No. 841
Waihee Reservoir No. 842
Waihee Reservoir No. 843
Waihee Reservoir No. 844
Waihee Reservoir No. 845
Waihee Reservoir No. 846
Waihee Reservoir No. 847
Waihee Reservoir No. 848
Waihee Reservoir No. 849
Waihee Reservoir No. 850
Waihee Reservoir No. 851
Waihee Reservoir No. 852
Waihee Reservoir No. 853
Waihee Reservoir No. 854
Waihee Reservoir No. 855
Waihee Reservoir No. 856
Waihee Reservoir No. 857
Waihee Reservoir No. 858
Waihee Reservoir No. 859
Waihee Reservoir No. 860
Waihee Reservoir No. 861
Waihee Reservoir No. 862
Waihee Reservoir No. 863
Waihee Reservoir No. 864
Waihee Reservoir No. 865
Waihee Reservoir No. 866
Waihee Reservoir No. 867
Waihee Reservoir No. 868
Waihee Reservoir No. 869
Waihee Reservoir No. 870
Waihee Reservoir No. 871
Waihee Reservoir No. 872
Waihee Reservoir No. 873
Waihee Reservoir No. 874
Waihee Reservoir No. 875
Waihee Reservoir No. 876
Waihee Reservoir No. 877
Waihee Reservoir No. 878
Waihee Reservoir No. 879
Waihee Reservoir No. 880
Waihee Reservoir No. 881
Waihee Reservoir No. 882
Waihee Reservoir No. 883
Waihee Reservoir No. 884
Waihee Reservoir No. 885
Waihee Reservoir No. 886
Waihee Reservoir No. 887
Waihee Reservoir No. 888
Waihee Reservoir No. 889
Waihee Reservoir No. 890
Waihee Reservoir No. 891
Waihee Reservoir No. 892
Waihee Reservoir No. 893
Waihee Reservoir No. 894
Waihee Reservoir No. 895
Waihee Reservoir No. 896
Waihee Reservoir No. 897
Waihee Reservoir No. 898
Waihee Reservoir No. 899
Waihee Reservoir No. 900
Waihee Reservoir No. 901
Waihee Reservoir No. 902
Waihee Reservoir No. 903
Waihee Reservoir No. 904
Waihee Reservoir No. 905
Waihee Reservoir No. 906
Waihee Reservoir No. 907
Waihee Reservoir No. 908
Waihee Reservoir No. 909
Waihee Reservoir No. 910
Waihee Reservoir No. 911
Waihee Reservoir No. 912
Waihee Reservoir No. 913
Waihee Reservoir No. 914
Waihee Reservoir No. 915
Waihee Reservoir No. 916
Waihee Reservoir No. 917
Waihee Reservoir No. 918
Waihee Reservoir No. 919
Waihee Reservoir No. 920
Waihee Reservoir No. 921
Waihee Reservoir No. 922
Waihee Reservoir No. 923
Waihee Reservoir No. 924
Waihee Reservoir No. 925
Waihee Reservoir No. 926
Waihee Reservoir No. 927
Waihee Reservoir No. 928
Waihee Reservoir No. 929
Waihee Reservoir No. 930
Waihee Reservoir No. 931
Waihee Reservoir No. 932
Waihee Reservoir No. 933
Waihee Reservoir No. 934
Waihee Reservoir No. 935
Waihee Reservoir No. 936
Waihee Reservoir No. 937
Waihee Reservoir No. 938
Waihee Reservoir No. 939
Waihee Reservoir No. 940
Waihee Reservoir No. 941
Waihee Reservoir No. 942
Waihee Reservoir No. 943
Waihee Reservoir No. 944
Waihee Reservoir No. 945
Waihee Reservoir No. 946
Waihee Reservoir No. 947
Waihee Reservoir No. 948
Waihee Reservoir No. 949
Waihee Reservoir No. 950
Waihee Reservoir No. 951
Waihee Reservoir No. 952
Waihee Reservoir No. 953
Waihee Reservoir No. 954
Waihee Reservoir No. 955
Waihee Reservoir No. 956
Waihee Reservoir No. 957
Waihee Reservoir No. 958
Waihee Reservoir No. 959
Waihee Reservoir No. 960
Waihee Reservoir No. 961
Waihee Reservoir No. 962
Waihee Reservoir No. 963
Waihee Reservoir No. 964
Waihee Reservoir No. 965
Waihee Reservoir No. 966
Waihee Reservoir No. 967
Waihee Reservoir No. 968
Waihee Reservoir No. 969
Waihee Reservoir No. 970
Waihee Reservoir No. 971
Waihee Reservoir No. 972
Waihee Reservoir No. 973
Waihee Reservoir No. 974
Waihee Reservoir No. 975
Waihee Reservoir No. 976
Waihee Reservoir No. 977
Waihee Reservoir No. 978
Waihee Reservoir No. 979
Waihee Reservoir No. 980
Waihee Reservoir No. 981
Waihee Reservoir No. 982
Waihee Reservoir No. 983
Waihee Reservoir No. 984
Waihee Reservoir No. 985
Waihee Reservoir No. 986
Waihee Reservoir No. 987
Waihee Reservoir No. 988
Waihee Reservoir No. 989
Waihee Reservoir No. 990
Waihee Reservoir No. 991
Waihee Reservoir No. 992
Waihee Reservoir No. 993
Waihee Reservoir No. 994
Waihee Reservoir No. 995
Waihee Reservoir No. 996
Waihee Reservoir No. 997
Waihee Reservoir No. 998
Waihee Reservoir No. 999
Waihee Reservoir No. 1000

U S GEOLOGICAL SURVEY
GEORGE OTIS SMITH DIRECTOR

156°10′ 50′ 40′ 30′ 20′ 10′ 155°00′ 154°50′

19°50′ 19°40′ 19°30′ 19°20′ 19°10′

ALEN'UIHAHA CHANNEL

PACIFIC OCEAN

Upolu Pt
Hawi Mill
Elev 600′
Mahukona Harbor
Kawaihae Harbor
Kiholo Bay
Keahole Pt
Kailua Bay
Holualoa
Elev 1,350′
Kauhou Bay
Kealakekua
Elev 1,580′
Kealakekua Bay
Napoopoo
Elev 25′
Honaunau Bay
Puuwaawaa
Elev 2,740′
Huehue
Elev 2,000′
Hualalai
Elev 8,275
Kohala Mts
Elev 5,489
Kawainui mauka
Elev 4,080′
Honokane
Elev 1,042′
Kawainui
Elev 1,040′
Waimea
Elev 2,720′
Mauna Kea
Elev 13,825
Mauna Loa
Elev 13,675′
Crater of Mokuaweoweo
Puu Oo
Elev 6,450′
Humuula
Elev 6,685′
Volcano House
Elev 3,970′
Crater of Kilauea
Honokaa mauka
Elev 1,100′
Paauhau
Elev 1,150′
Kalopa
Elev 900′
Coffee Plantation
Elev 1,600′
Umikoa Ranch
Elev 3,400′
Hapea
Elev 4,000′
Hapea mauka
Elev 5,000′
Keanakolu
Elev 5,500′
Puu Kihe
Elev 7,850′
Pepeekeo
Papaikou
Hilo Breakwater
Elev 15′
Waiakea Mill
Elev 50′
Ponahawai
Elev 500′
Pihonua-mauka
Elev 1,900′
Olaa Mill
Elev 210′
Kurtistown
Elev 640′
Mountain View
Elev 1,530′
Pahoa
Elev 700′
Green Lake
Elev 110′
Kapoho
Cape Kumukahi
Kaueleau
Elev 1,000′

NORTH KOHALA
SOUTH KOHALA
NORTH KONA
SOUTH KONA
NORTH HAMAKUA
SOUTH HAMAKUA
NORTH HILO
SOUTH HILO
PUNA

Upper Kohala Ditch
Woods Ditch
New Hamakua Ditch
Pacific S.M.Co Ditch
Upper Hamakua Ditch
Alakahi Str
Koiawe Str
Waima Str
Awini Stream
Honokane Stream
Pololu Stream
Waimanu Stream
Waipio River
Paauilo Gulch
Ookala Gulch
Kawaiii Gulch
Laupahoehoe Gulch
Papaaloa Stream
Maulua Gulch
Waikaumalo Stream
Honohina
Hakalau Stream
Kolekole Stream
Honomu Stream
Kawainui River
Hanawai Stream
Kapue Stream
Waipahoehoe Stream
Honolii River
Awini Str
Maili Str
Kapahu
Waiuku
Pukihae
Hilo Bay
Wailuku River

A-B Stations No. 1 to 87 on 2500 foot contour

DRAINAGE MAP OF THE ISLAND OF HAWAII TERRITORY OF HAWAII

Scale 1:250,000

10 0 10 Miles

1913

TRUE NORTH
MAGNETIC NORTH

- Stream gaging station
- Rainfall station
- Evaporation station

A-B Stations No. 1 to 87 on 2,500 foot contour

NORTH KONA

SOUTH KONA

NORTH HAMAKUA

SOUTH HAMAKUA

HILO

PUNA

KAU

PACIFIC OCEAN

Keahole Pt

Huehue
58
Elev. 2,000'

Hualalai
Elev. 8,275

Kailua Bay

Holualoa
59
Elev. 1,350'

Keauhou Bay

Kealakekua
Elev. 1,580'
60

61
Napoopoo
Elev. 25'

Kealakekua Bay

Honaunau Bay

Kauhako Bay

Mauna Loa
Elev. 13,675'

Crater of Mokuaweoweo

Humuula
1
Elev. 6,685'

Puu Oo
2
Elev. 6,450'

Papaikou

Kapue Stream

Waipahoehoe Stream

Honolii River

Hilo Breakwater

Hilo Bay

Elev. 15'

Waiakea Mill

Ponahawai
5
Elev. 500'

Elev. 50'

Pinonua mauka
3
Elev. 1,900'

Wailuku River

Waiakea Stream

Awehi Str.

Maili Str.

Kapehu

Pukihae

Olaa Mill
71
Elev. 210'

Kurtistown
70
Elev. 640'

Mountain View
69
Elev. 1,530'

Pahoa
72
Elev. 700'

Green Lake
74
Elev. 110'

Kapoho
Cape Kumukahi

Kaueleau
73
Elev. 1,000'

Volcano House
68
Elev. 3,970'

Crater of Kilauea

Kau Desert

PROPOSED KAU DITCH

Kapapala Ranch
67
Elev. 2,150'

Pahala
66
Elev. 850'

Hilea
65
Elev. 310'

Punaluu Harbor

Kau
63
Elev. 1,850'

Homesteads
64

Naalehu
Elev. 650'

Honuapo Harbor

Kaalualu Harbor

Ka Lae

Hoopuloa
62
Elev. 2,425'

Hoopuloa Ldg

Okoe Ldg

156°00'

19°00'

Based upon maps of the Hawaii Territory Survey and miscellaneous data